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D-33-3-6-6
CT-02-FS-D(2)-I

FEASIBILITY STUDY

CALDWELL TRUCKING COMPANY SITE
TOWNSHIP OF FAIRFIELD, NEW JERSEY

EPA WORK ASSIGNMENT
NUMBER 69-2LB3
CONTRACT NUMBER 68-01-6699

NUS PROJECT NUMBER S796

JUNE 1986

NUS CORPORATION

Park West Two
Cliff Mine Road
Pittsburgh, PA 15275
412-788-1080

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SUBMITTED FOR NUS BY:

Leonard C. Johnson

LEONARD C. JOHNSON
PROJECT MANAGER

APPROVED:

Debra M Wroblewski

DEBRA WROBLEWSKI
REGIONAL MANAGER
REGION II

CTC 001 1086

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EXECUTIVE SUMMARY

The Feasibility Study (FS) Report for the Caldwell Trucking Company Site was prepared at the request of the United States Environmental Protection Agency (EPA) Region II, under Work Assignment Number 69-2LB3, Contract Number 68-01-6699. This study was prepared in accordance with the requirements of the National Oil and Hazardous Substances Contingency Plan (NCP) published pursuant to Section 105 of the Comprehensive Environemtnal Response, Compensation, and Liability Act of 1980 (CERCLA).

The purpose of the FS is to develop and evaluate remedial action alternatives for various site problems using information collected during the Remedial Investigation (RI) and through local, state and Federal agencies. The methodology for preparing the FS follows the steps outlined in the Feasibility Study Guidance Document (EPA, June, 1985).

Site Background

The Caldwell Trucking Company Site is located in the Fairfield Township, Essex County, New Jersey. The site is a 15-acre tract of land located in the eastern portion of the township, between O'Connor Drive and Sherwood Lane, immediately east of the Passiac Avenue.

The Caldwell Trucking Company has been in operation at the site since 1933. It has handled domestic and industrial septic tank waste. Some of these wastes are believed to have contained solvents and other contaminants. The waste was chlorinated for disinfection with granulated hypochlorite in open, unlined lagoons. Sludge from the lagoons was periodically cleaned out and disposed off site. Clarified lagoon water was transported to an unlined disposal pond within the site area and allowed to filter into the subsurface.

Dumping at the Caldwell Trucking Company Site was discontinued in 1973 on the order of the New Jersey Department of Public Utilities (NJDPU). At present the site is operated as a transfer facility that receives wastes in tank trucks and transports the waste for disposal. The site includes an office and three steel holding tanks having a total capacity of 100,000 gallons. The lagoons have been backfilled and closed.

An extensive investigation (the RI) was conducted on the site and in the vicinity of the site to characterize the known and suspected sources of contamination. It was originally proposed to also investigate the General Hose Products Inc., facility located adjacent to the Caldwell Trucking Company, as a co-contributor to the contamination in the area. However, as the investigation on the Caldwell Trucking Company property progressed, it became apparent that an extensive investigation of the General Hose Products Inc., facility would be needed to adequately characterize the nature and extent of contamination there. It will also be necessary to confirm, through additional study, the presence or absence of additional sources of groundwater, soil, surface water and sediment contamination in the area.

Groundwater is the major source of drinking water in Fairfield Township. The Township of served by a widespread network of municipal production wells. Widespread sampling of domestic, municipal, and industrial wells in the vicinity of the site has revealed the presence of a variety of halogenated hydrocarbons. A plume of contamination extends hydraulically downgradient about 4,000 feet in a northeasterly direction from the site, toward the Passaic River. Many groundwater samples from this plume contain more than 1,000 parts per billion (ppb) of total volatile organics. The RI included a limited investigation of the plume area.

In previous investigations by the local health department and the New Jersey Department of Environmental Protection (NJDEP), two municipal water supply wells were found to be contaminated. One of the wells was determined by the NJDEP to be contaminated from a source not related to the site, since it contained several contaminants that were not found at the site or in the other well (Municipal Well No. 7). Thus it was not included in the RI. The other well (Municipal Well No. 7), however, was suspected to be affected by contamination from the site and was included in the RI. Well No. 7 is located hydraulically upgradient from the site approximately 3,000 feet south of the site.

Remedial Investigation Results

The objectives of the RI were to collect appropriate data to assess the impact of the site on the public health and environment and to evaluate the feasibility of remedial measures. To meet these objectives, the RI was planned to identify and characterize contaminant sources and migration pathways. As part of the RI, a quantitative Risk Assessment was performed to address present public health and environmental concerns. Appropriate data were collected through various field investigations. The activities and findings of these studies are summarized below.

Subsurface Investigation

- Nineteen monitoring wells were installed in the area surrounding and on the site to determine subsurface conditions, particularly to the southwest of the site, to provide observation wells for an aquifer pumping test of the contaminated Municipal Well No. 7, and to provide groundwater sampling points. These wells, as well as six existing monitoring wells, were sampled twice during the RI.

- Eighteen soil borings were drilled on the site to obtain soil samples in the former waste disposal areas (lagoon areas). These samples were used to characterize the vertical and horizontal extent of contamination in these areas.

- An aquifer pumping test of Municipal Well No. 7 was conducted to investigate the effect of long term pumping of Well No. 7 on the hydraulic gradient between the site and the well and to provide information on the aquifer characteristics in that area.

- Seven residential wells were sampled in the downgradient plume area to provide additional information on the extent of contamination in the plume area and to provide data to assess the risks associated with exposure to the contaminated groundwater.

The findings of these subsurface investigations are listed below.

- Geology consists of unconsolidated glacial sediments overlying basalt bedrock.

- Groundwater occurs in both the glacial deposits and in fractured bedrock. The glacial deposits and bedrock are hydraulically connected.

- Regional groundwater flow in both aquifers is to the northeast, toward the Passiac River.

- There is a plume of contaminated groundwater extending from the site to the Passaic River. The lateral extent of the plume to the northwest is not well defined at this time.

- Hydraulic gradients in the area, in both aquifers, are influenced by pumping of local industrial and municipal water supply wells.

- Chlorinated aliphatic compounds are the major groundwater contaminant in the area. Of these, trichloroethylene and related compounds constitute the greatest proportion.

- Onsite subsurface soils in the former lagoon areas are contaminated with chlorinated aliphatics, polynuclear aromatic hydrocarbons, polychlorinated biphenyls, (PCBs), and lead.

- Contaminated groundwater discharge is not currently or expected to significantly affect water quality in the Passiac River.

- The pumping test demonstrated that long term pumping of Municipal Well No. 7 reversed the hydraulic gradient between the well and the site. Also, local groundwater flow is significantly influenced by other pumping wells near the site.

- Groundwater contamination was detected at the site, downgradient of the site in the contaminant plume area, and upgradient of the site in the area of Municipal Well No. 7. However, no contamination was detected in the upgradient area between the site and Municipal Well No. 7.

- The major health risk at the site is associated with ingestion or domestic use of contaminated groundwater. Although there are no data that indicate the receptors in the plume are currently exposed to significant levels of contaminants in drinking water, any receptor in the vicinity of the site may be exposed at some future time, as a result of localized pumping influences or dispersion of the contaminant plume.

Surface Soil and Waste Investigation

- Seven septic disposal pits, located behind the General Hose Products Plant, were sampled along with an existing lagoon and three of the four holding tanks on Caldwell Trucking Company property.

- Surface soil and sediments on and around the site were sampled to investigate the extent of contamination and routes of sediment transport from the site. Twenty-eight locations were sampled.

These investigation revealed that:

- Surface soils throughout the site are contaminated with varying levels of PCBs and lead.

- The former waste disposal and storage areas are contaminated with varying levels of volatile organics, polynuclear aromatic hydrocarbons, PCBs and heavy metals.

- Direct contact with, or accidental ingestion of, contaminated onsite surface soils may be associated with chronic and carcinogenic health risks.

- Environmental receptors may be affected by the site. Inorganic compounds are the primary contaminants of concern for aquatic biota. PCBs and lead in onsite and offsite surface soils and sediments could potentially affect terrestrial biota.

<u>Surface Water and Sediment Investigation</u>

- Eight locations in Deepavaal Brook, the Passaic River and the unnamed tributaries to Deepavaal Brook were sampled for surface water and/or sediment to determine the extent of contamination in these areas and surface water transport routes from the site.

- Surface water and sediments in the vicinity of the site are contaminated to varying degrees with contaminants similar to those detected on the site. However, most areas are apparently contaminated from sources other than the Caldwell Trucking Company Site.

- Exposure to offsite surface water and sediment in the unnamed tributaries of Deepavaal Brook is of a concern due to high levels of volatile organics and PCBs found at the sample locations.

<u>Air Investigation</u>

Six air samples were collected on the site during completion of the soil borings. This was done to provide air quality data during ground disturbance on the site.

Air emissions from the site were observed during lagoon soil boring operations. Air sampling and monitoring indicated that, undisturbed, the site poses little threat of air contamination. However, excavation of contaminated materials could lead to air emissions of site contaminants.

Feasibility Study Objectives and Criteria

The purpose of the FS process is to provide an array of technically sound, cost-effective remedial action alternatives that control the source and manage the migration of contaminants. As a result, protection of the public health, welfare, and the environment is provided.

Various remedial action objectives and target cleanup criteria were developed to address the public health and environmental risks posed by the migration of and exposure to contaminants. Contaminant pathways from the Caldwell Trucking Company Site that require remediation of the contaminant migration route include transported sediments, groundwater, and soils (including wastes). Exposures to these media include dermal contact, ingestion, and inhalation. Risks associated with these pathways have been estimated, based on present site conditions and future potential risks, if determinable. The future potential risks were based on conservative estimates of contaminant migration (i.e., worse-case and most-probable-case scenarios). General response actions were identified for both present and future risks, if found to be above target risk levels.

Remedial action objectives focused on either preventing an increase in the present risk level or reducing the present or potential future risks to target levels for each exposure pathway. The target level of risk was defined as being within EPA's specified range of 10^{-4} to 10^{-7}. For example, if the present or future risk is estimated at 10^{-2} (above EPA's range), the objectives focused on reducing the risk to 10^{-4} or 10^{-6}, if feasible.

Screening of Remedial Technologies and Development of Alternatives

Feasible remedial action technologies were selected based on their achieving the remedial objectives and cleanup criteria defined for the contaminant migration pathways. Technologies not meeting the site cleanup objectives and criteria were eliminated from further consideration, whereas those remaining were screened using additional criteria. These criteria include technical feasibility, public health and environmental impacts, costs, and institutional constraints.

Remedial Action Alternatives (RAAs) were developed from the remaining technologies to address all remedial action objectives. Alternatives judged to have significant adverse impacts or that were judged to be significantly higher in cost without providing additional environmental or health benefits were excluded from further consideration. The remaining alternatives were further evaluated according to the same criteria used to evaluate the technologies, i.e., technical performance, magnitude of costs, etc.

Summary of Remedial Action Alternatives

The complexity of the site problems, the widespread contamination in the area and the presence of other potential sources of contamination complicated the development of comprehensive remedial alternatives that address all the problems in the area. Therefore, the alternatives were divided into remedial components based on the particular problem being considered. Three remedial components were developed along with eleven remedial action alternatives. These remedial components and the corresponding alternatives are listed below.

- Remedial Component 1 - Remediation of Municipal Well No. 7
  - Remedial Action Alternative No. 1 - No Action
  - Remedial Action Alternative No. 2 - Purchase of Water from Passaic Valley Water Commission.

- Remedial Action Alternative No. 3 - Wellhead Treatment of Municipal Well No. 7

• Remedial Component 2 - Remediation of Downgradient Contaminant Plume

  - Remedial Action Alternative No. 4 - No Action with Monitoring

  - Remedial Action Alternative No. 5 - Alternative Water Supply and Sealing of Private Wells.

• Remedial Component No. 3 - Remediation of Onsite Wastes and Contaminated Soils

  - Remedial Action Alternative No.6 - No Action

  - Remedial Action Alternative No. 7 - Capping

  - Remedial Action Alternative No. 8 - Excavation and Disposal in an Offsite Secure Landfill

  - Remedial Action Alternative No. 9 - Excavation and Disposal in an Onsite Secure Landfill

  - Remedial Action Alternative No. 10 - Excavation and Offsite Incineration

  - Remedial Action Alternative No. 11 - Excavation, Onsite Incineration and Solidification.

Each of these alternatives is described and analyzed in detail in Sections 3.0 and 4.0 of the FS Report. The capital and baseline present worth costs for each alternative are summarized in Table ES-1.

TABLE ES-1

REMEDIAL ACTION ALTERNATIVES COST SUMMARY
CALDWELL TRUCKING COMPANY SITE
(Costs are in 1986 Dollars)

Remedial Action Alternative	Capital Cost ($1,000)	Present-Worth Costs ($1,000) Baseline
Remedial Component 1		
1. No action	-0-	-0-
2. Purchase of water from Passaic Valley Water Commission	-0-	297
3. Wellhead treatment of Municipal Well No. 7	222	288
Remedial Component 2		
4. No action/monitoring	-0-	332
5. Alternative water supply and sealing of private wells	269	269
Remedial Component 3		
6. No action	-0-	-0-
7. Capping	740	911
8. Excavation and offsite landfill	18,188	18,434
9. Excavation and onsite landfill	3,166	3,554
• With low temperature vaporization loop	3,666	4,053
10. Excavation and offsite incineration	49,056	49,302
11. Excavation, onsite incineration, and solidification	42,463	42,709

1.0 INTRODUCTION

This Feasibility Study was prepared in response to U.S. Environmental Protection Agency (EPA) Work Assignment No. 69-2LB3 under Contract No. 68-01-6699. The purpose of the Feasibility Study (FS) is to develop and assess remedial action alternatives based on site-specific conditions and to present to the EPA a range of at least five potential alternatives for remediation of the Caldwell Trucking Company Site. At a minimum, one alternative should be developed for each of the five EPA categories outlined in the FS Guidance Document (EPA, April 1985). These categories are described later in Section 2.0 and include the no-action alternative.

The methodology for preparation of the FS follows the steps as prescribed by the National Contingency Plan and outlined in the Guidance Document. These steps are as follows:

- Identify General Response Actions
  - Identify site problems and pathways of contamination (remedial investigation).
  - Identify general response actions that address site problems and satisfy remediation goals and objectives.
- Identify and Screen Technologies and Develop Remedial Alternatives
  - Identify possible technologies in each general response action, then screen the technologies to eliminate inapplicable and infeasible technologies based on site conditions.
  - Assemble technologies into alternatives based on the remaining feasible technologies.

- Screen Public Health, Environmental, and Cost Factors

  - Screen alternatives, eliminating those that have significant adverse impacts or that obviously do not adequately protect the environment, public health, and public welfare.

  - Screen alternatives, eliminating those that are an order of magnitude higher in cost than other alternatives but do not provide significantly greater environmental or public health benefits or technical reliability.

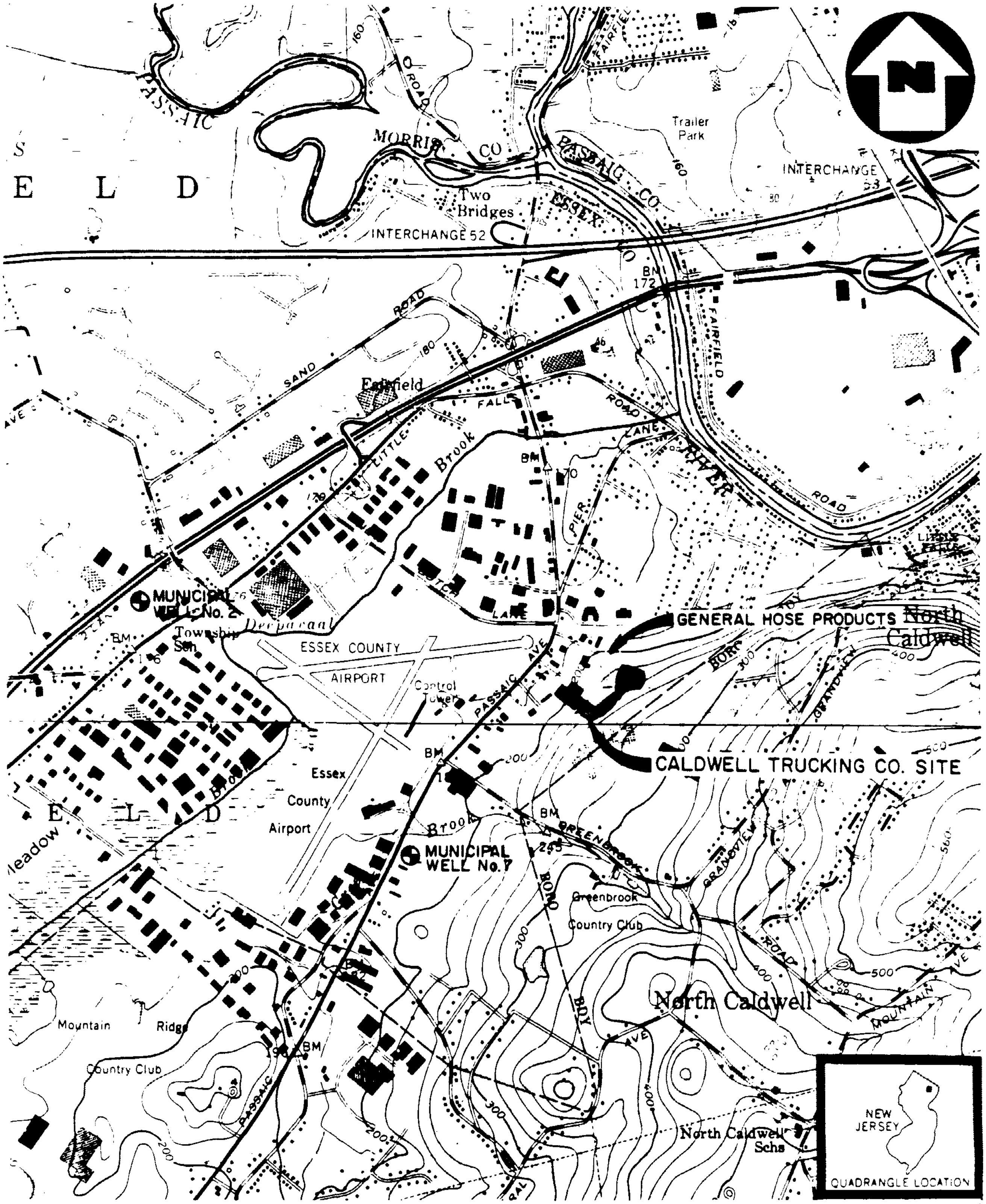
The data needed to develop the remedial action alternatives were generated during the remedial investigation (RI). Details of the site and the investigation findings have been provided in the Remedial Investigation Report. The information is summarized briefly in Sections 1.1, 1.2, and 1.3.

1.1 Site Background Information

The Caldwell Trucking Company Site (hereafter referred to as the site) is located in Fairfield Township, Essex County, New Jersey. The site is a 15-acre tract of land located in the eastern portion of the township, between O'Connor Drive and Sherwood Lane, immediately east of Passaic Avenue. Map coordinates for the site are latitude 40°53'23" north, longitude 74°16'16" west on the Pompton Plains 7.5 minutes series quadrangle map, as shown on Figure 1-1.

The site is located on a hillside adjacent to a broad floodplain area of the Passaic River. Ground elevations on the site range from approximately 185 feet to 210 feet mean sea level. The 100-year floodplain elevation of the Passaic River is 171.5 feet mean sea level. No wetlands are located within the site boundaries.

The Caldwell Trucking Company has been in operation at the site since 1933. It has handled domestic and industrial septic tank waste. Some of these wastes are believed to have contained solvents and other contaminants. The waste was



BASE MAP IS A PORTION OF THE U.S.G.S. POMPTON PLAINS, NJ QUADRANGLE (7.5 MINUTE SERIES, 1955, PHOTOREVISED 1981) AND A PORTION OF THE CALDWELL, NJ QUADRANGLE (7.5 MINUTE SERIES, 1954, PHOTOREVISED 1981).
CONTOUR INTERVAL 20'.

FIGURE 1-1

LOCATION MAP

CALDWELL TRUCKING CO. SITE, FAIRFIELD TWP., NJ

SCALE: 1" = 2000'

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chlorinated for disinfection with granulated hypochlorite in open, unlined lagoons. Sludge from the lagoons was periodically cleaned out and disposed off site. Clarified lagoon water was transported to an unlined disposal pond within the site area and allowed to filter into the subsurface.

Dumping at the Caldwell Trucking Company Site was discontinued in 1973 on the order of the New Jersey Department of Public Utilities (NJDPU). At present the site is operated as a transfer facility that receives wastes in tank trucks and transports the waste for disposal. The site includes an office and three steel holding tanks having a total capacity of 100,000 gallons. The lagoons have been backfilled and closed.

1.2 Nature and Extent of the Problem

Groundwater is the major source of drinking water in Fairfield Township. The Township is served by a widespread network of municipal production wells. Widespread sampling of domestic, municipal, and industrial wells in the vicinity of the site has revealed the presence of a variety of halogenated hydrocarbons. A plume of contamination extends about 4,000 feet in a northeasterly direction from the site, toward the Passaic River. Many groundwater samples from this plume contain more than 1,000 parts per billion (ppb) of total volatile organics.

In previous investigations by the local health department and the New Jersey Department of Environmental Protection (NJDEP), Municipal Wells No. 7 and 2, shown on Figure 1-1, were found to be contaminated. The location of Well No. 7 suggests that it is not in the downgradient direction of groundwater flow from the site. The contamination may have migrated to the well from the site because of pumping effects and/or from contaminant sources other than the Caldwell Trucking Company Site. Well No. 2 was determined by the NJDEP to be contaminated from a source not related to the site, since it contained several contaminants that were not found at the site or in Well No. 7.

Surface water at the site flows into ditches that join Deepavaal Brook to the west and into storm drains on adjacent roadways. Deepavaal Brook flows north into the Passiac River. Sampling and analysis of surface water and sediment in the general area indicates widespread, low-level, volatile organics contamination of water and sediment and limited PCB contamination of sediments. However, since only one of the seven sampling locations could likely be influenced by runoff from the site, the evidence indicates that other sources are contributing to contamination in these areas.

Contaminated sludges and surface and subsurface soil remain on the site. Drilling and soil sampling revealed concentrations of volatile organics, inorganics, and PCBs in the parts-per-million range in the former lagoon areas. Contaminated soil was found from 3 to 35 feet, where bedrock was encountered. Site soils may act as a continuing source of contamination to groundwater via leaching.

1.3 Major Findings of the Remedial Investigation

- Geology consists of unconsolidated glacial sediments overlying basalt bedrock.

- Groundwater occurs in both the glacial deposts and in fractured bedrock. The glacial deposits and bedrock are hydraulically connected.

- Regional groundwater flow in both aquifers is to the northeast, toward the Passaic River.

- There is a plume of contaminated groundwater extending from the site to the Passaic River. The lateral extent of the plume to the northwest is not well defined at this time. A summary of groundwater contamination detected in the monitoring well and residential well samples taken during the RI is shown in Table 1-1.

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TABLE 1-1

SUMMARY OF GROUNDWATER CONTAMINATION
CALDWELL TRUCKING COMPANY SITE

			Monitoring Wells		Residential Wells	
PP #	CAS #	Contaminant	Concentration Range (μg/l)	Number of Occurrences	Concentration Range (μg/l)	Number of Occurrences
44V	75-09-2	Methylene Chloride	130 - 13,000	8/52	180 - 12,500	2/7
29V	75-35-4	1,1-Dichloroethene	2 - 560	16/52	397 - 400	2/7
10V	75-34-3	1,1-Dichloroethane	1 - 1,100	17/52	140 - 150	2/7
30V	156-60-5	Trans-1,2-Dichloroethene	1 - 12,000	26/52	1,200 - 1,500	2/7
23V	67-66-3	Chloroform	1.9 - 4,400	21/52	3,160 - 3,600	2/7
11V	71-55-6	1,1,1-Trichloroethane	3.8 - 9,600	27/52	1,915 - 3,500	2/7
87V	79-01-6	Trichloroethene	4.1 - 36,000	37/52	7.4 - 14,000	4/7
85V	127-18-4	Tetrachloroethene	1 - 3,000	23/52	380	2/7
88V	75-01-4	Vinyl Chloride	110 - 4,900	4/52	ND	
16V	75-00-3	Chloroethane	110	1/52	ND	
4V	71-43-4	Benzene	14 - 16	2/52	22 - 40	2/7
86V	108-88-3	Toluene	1.4 - 65	3/52	ND	
65A	108-95-2	Phenol	10	8/52	ND	
26B	543-73-1	1,3-Dichlorobenzene	10 - 20	2/52	ND	
27B	106-46-7	1,4-Dichlorobenzene	19 - 43	3/52	ND	
25B	95-50-1	1,2-Dichlorobenzene	15 - 270	3/52	ND	
7V	108-90-7	Chlorobenzene	2.5 - 3.6	2/52	ND	
8B	120-82-1	1,2,4-Trichlorobenzene	2	1/52	ND	
NP	67-64-1	Acetone	57 - 110,000	4/52	410	1/7
NP	78-93-3	2-Butanone	5.9 - 6.3	1/52	ND	
NP	591-78-6	2-Hexanone	5 - 93	2/52	ND	
NP	108-10-1	4-methyl-2-pentanone	64	1/52	ND	
70B	117-84-0	Diethylphthalate	1	3/52	ND	ND
69B	84-66-2	Di-n-Octyl phthalate	20	1/52	ND	
66B	117-84-0	Bis(2-ethylhexyl)phthalate	1.4 - 1,700	11/52	ND	
1B	83-32-9	Acenaphthene	2	1/52	ND	
73B	50-32-8	Benzo(a)pyrene	2.7 - 8	2/52	ND	
79B	191-24-2	Benzo(g,h,i)perylene	3.1	1/52	ND	
74B	205-99-2	Benzo(b)fluoranthene	3.3	1/52	ND	
75B	207-08-9	Benzo(k)fluoranthene	3.3	1/52	ND	

TABLE 1-1
SUMMARY OF GROUNDWATER CONTAMINATION
CALDWELL TRUCKING COMPANY SITE
PAGE TWO

			Monitoring Wells		Residential Wells	
PP #	CAS #	Contaminant	Concentration Range (µg/l)	Number of Occurrences	Concentration Range (µg/l)	Number of Occurrences
103P	319-85-7	Beta BHC	0.01	1/52	ND	
106P	53469-21-9	Arochlor 1242	40	1/52	ND	
107P	11097-69-1	Arochlor 1254	4.5	1/52	ND	
97P	1031-07-8	Endosulfan sulfate	ND		0.17	1/7
95P	959-98-8	Endosulfan I	0.01	1/52	ND	
NP	75-15-0	Carbon disulfide	500	1/52	ND	
NP	100-51-6	Benzyl alcohol	20	1/52	ND	
6V	56-23-5	Carbon tetrachloride	5-44	4/52	ND	
		Total xylenes	5 - 35	3/52	ND	

Notes:

NP = Non-Priority Pollutant
ND = Not Detected

- Hydraulic gradients in the area, in both aquifers, are influenced by pumping of local industrial and municipal water supply wells.

- Chlorinated aliphatic compounds are the major groundwater contaminant in the area. Of these, trichloroethylene and related compounds constitute the greatest proportion (see Table 1-1).

- Surface soils throughout the site are contaminated with varying levels of PCBs and lead. A summary of onsite surface soil contamination is shown in Table 1-2.

- Onsite subsurface soils in the former lagoon areas are contaminated with chlorinated aliphatics, polynuclear aromatic hydrocarbons, polychlorinated biphenyls, (PCBs), and lead. Tables 1-3 and 1-4 summarize the subsurface soil contamination detected in samples taken in the monitoring well boreholes and in the former lagoon areas during the remedial investigation.

- Surface water and sediments in the vicinity of the site are contaminated to varying degrees with contaminants similar to those detected on the site. However, all but one location is most likely contaminated from sources other than the Caldwell Trucking Company Site. Tables 1-5 and 1-6 summarize surface water and sediment contamination detected in offsite areas during the remedial investigation.

- Groundwater contamination was detected during this study upgradient of the site in the area of Municipal Well No. 7, downgradient of the site and at the site. Groundwater contamination was not detected in monitoring wells between the site and Municipal Well No. 7. Groundwater flow in the area of the site is significantly influenced by industrial and municipal pumping wells near the site. Pumping of Municipal Well No. 7, at 390 gpm for extended periods, reversed the hydraulic gradient between the site and the well.

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TABLE 1-2

SUMMARY OF ORGANIC SURFACE SOIL/SEDIMENT CONTAMINATION
CALDWELL TRUCKING COMPANY SITE

PP #	CAS #	Contaminant Name	Concentration Range (µg/kg)	Number of Occurrences/ Number of Samples
		Chlorinated Aliphatics		
30V	156-60-5	trans-1,2-dichloroethene	5	1/27
85V	127-18-4	tetrachloroethene	5 - 7,500	4/27
87V	79-01-6	trichloroethene	5 - 5,800	5/27
23V	67-66-3	chloroform	33	1/27
11V	71-55-6	1,1,1-trichloroethane	5 - 1,300	2/27
		Monocyclic Aromatics		
86V	108-88-3	toluene	5 - 560	6/27
38V	100-41-4	ethylbenzene	5 - 4,200	3/27
		total xylenes	5 - 25,000	10/27
		Polynuclear Aromatics		
55B	91-20-3	naphthalene	310	1/27
1B	83-32-9	acenaphthene	330	1/27
80B	86-73-7	fluorene	330	1/27
81B	85-01-8	phenanthrene	330 - 2,600	5/27
78B	120-12-7	anthracene	330	2/27
39B	206-44-0	fluoranthene	330 - 6,100	6/27
84B	129-00-0	pyrene	330 - 3,900	5/27
72B	56-55-3	benzo(a)anthracene	330 - 2,500	4/27
76B	218-01-9	chrysene	410 - 3,800	4/27
74B	205-99-2	benzo(b)fluoranthene	330 - 3,300	4/27
75B	207-06-9	benzo(k)fluoranthene	330 - 2,700	4/27
73B	50-33-8	benzo(a)pyrene	330 - 2,800	4/27
83B	193-39-5	ideno(1,2,3-cd)pyrene	330 - 440	2/27
79B	191-24-2	benzo(g,h,i)perylene	330 - 1,400	3/27
NP	106-47-8	4-chloroaniline	330	1/27

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TABLE 1-2
SUMMARY OF SURFACE SOIL/SEDIMENT CONTAMINATION
CALDWELL TRUCKING COMPANY SITE
PAGE TWO

PP #	CAS #	Contaminant Name	Concentration Range (μg/kg)	Number of Occurrences/ Number of Samples
		Phthalate Esters		
70B	84-66-2	diethyl phthalate	330	1/27
66B	117-81-7	bis(2-ethylhexyl)phthalate	490	1/27
		Pesticides/PCBs		
94P	74-54-8	4,4'-DDD	17 - 210	2/27
112P	12674-11-2	Aroclor 1016	24,000	1/27
110P	12672-29-6	Aroclor 1248	280 - 76,000	4/27
107P	11097-69-1	Aroclor 1254	210 - 890	5/27
95P	959-98-8	Endosulfan I	8.9	1/27
111P	11096-82-5	Aroclor 1260	140 - 2,100	2/27
92P	50-29-3	4,4'-DDT	95	1/27

Notes:

NP = Non-Priority Pollutant

TABLE 1-3

SUMMARY OF SUBSURFACE SOIL INORGANIC CONTAMINATION
CALDWELL TRUCKING COMPANY SITE

PP #	Subsurface Soils Contaminant Name	Concentration Range (µg/kg)	Number of Occurrences/ Number of Samples
1	Aluminum	7,150 - 35,600	27/27
3	Arsenic	3.1 - 32	24/27
4	Barium	16 - 947	25/27
5	Beryllium	0.5 - 1.6	19/27
6	Cadmium	1.2 - 43	24/27
7	Calcium	143 - 44,800	23/27
8	Chromium	6.4 - 437	27/27
9	Cobalt	10 - 50	25/27
10	Copper	36 - 167	12/27
11	Iron	15,600 - 80,600	27/27
12	Lead	10 - 8,860	27/27
13	Magnesium	2,730 - 31,400	27/27
14	Manganese	222 - 1,640	27/27
15	Mercury	0.2 - 3.5	7/27
16	Nickel	6.3 - 159	25/27
17	Potassium	90 - 2,920	25/27
19	Silver	16 - 49	2/27
20	Sodium	86 - 2,880	16/27
23	Vandium	30 - 147	27/27
24	Zinc	20 - 727	27/27
21	Tallium	4.3 - 7.6	5/27

TABLE 1-4

SUMMARY OF SUBSURFACE SOIL ORGANIC CONTAMINATION
CALDWELL TRUCKING COMPANY SITE

	Subsurface Soils			
PP #	CAS #	Contaminant Name	Concentration Range (µg/kg)	Number of Occurrences/ Number of Samples
30V	156-60-5	Trans-1,2-Dichloroethene	3.1 - 21,000	9/58
23V	67-66-3	Chloroform	2.5 - 14,000	4/58
10V	107-06-2	1,1-Dichloroethane	180 - 30,000	3/58
11V	71-55-6	1,1,1-Trichloroethane	4.0 - 240,000	7/58
87V	79-01-6	Trichloroethene	100 - 790,000	10/58
85V	127-18-4	Tetrachloroethene	4.1 - 840,000	18/58
86V	108-88-3	Toluene	560 - 94,000	8/58
38V	100-41-4	Ethylbenzene	7.7 - 66,000	5/58
7V	108-90-7	Chlorobenzene	9	1/58
29V	75-35-4	1,1-Dichloroethene	160	1/58
65A	108-95-2	Phenol	280-15,000	4/56
62B	62-75-9	N-Nitrosodiphenylmine	410	1/58
26B	541-73-1	1,3-Dichlorobenzene	240 - 6,800	3/58
27B	106-46-7	1,4-Dichlorobenzene	260 - 16,000	7/58
25B	95-50-1	1,2-Dichlorobenzene	410 - 44,000	6/58
8B	120-82-1	1,2,4-Trichlorobenzene	310 - 3,400	2/58
55B	91-20-3	Napthalene	190 - 3,100	7/58
77B	208-96-8	Acenaphthylene	940	1/58
1B	83-32-9	Acenaphthene	180 - 2,800	4/58
80B	86-73-7	Fluorene	540 - 3,600	3/58
81B	85-01-8	Phenanthrene	350 - 8,900	5/58
68B	84-79-2	Di-n-butyl phthalate	280 - 380	2/58
39B	206-44-0	Fluoranthene	240 - 4,800	5/58
84B	129-00-0	Pyrene	230 - 9,000	4/58
67B	85-68-7	Butyl benzyl phthalate	220	1/58
66B	117-81-7	Bis(2-ethylhexyl)phthalate	180 - 9,000	16/58

TABLE 1-4
SUMMARY OF SUBSURFACE SOIL ORGANIC CONTAMINATION
CALDWELL TRUCKING COMPANY SITE
PAGE TWO

	Subsurface Soils			
PP #	CAS #	Contaminant Name	Concentration Range (µg/kg)	Number of Occurrences/ Number of Samples
93P	72-55-9	4,4'-DDE	620	1/58
94P	74-54-8	4,4'-DDD	8.4 - 4,000	2/58
92P	50-29-3	4,4'-DDT	120	1/58
106P	53469-21-9	Arochlor 1242	930 - 360,000	8/58
110P	12672-29-6	Arochlor 1248	340	1/58
107P	11097-69-1	Arochlor 1254	180 - 3,600	4/58
NP	75-15-0	Carbon disulfide	3.6	1/58
		Total xylenes	3.7 - 280,000	8/58
NP	95-48-7	2-Methylphenol	9,700 - 14,000	2/58
NP	106-44-5	4-Methylphenol	2,400 - 14,000	3/58
NP	65-85-0	Benzoic acid	1,100	1/58
NP	91-59-6	2-Methylnaphthalene	260 - 3,400	5/58
NP	132-64-9	Dibenzofuran	290 - 2,800	4/58

Notes:

NP = Non-Priority Pollutant

TABLE 1-5

SUMMARY OF ORGANIC SURFACE WATER CONTAMINATION
CALDWELL TRUCKING COMPANY SITE

PP #	CAS #	Contaminant Name	Concentration Range (µg/l)	Number of Occurrences/ Number of Samples
44V	75-09-2	Methylene chloride	44 - 854	7/8
29V	75-35-4	1,1-Dichloroethene	2.6	1/8
30V	156-60-5	Trans-1,2-Dichloroethene	9 - 420	4/8
23V	67-66-3	Chloroform	12	1/8
11V	71-55-6	1,1,1-Trichloroethane	520	1/8
87V	79-01-6	Trichloroethene	340	1/8
85V	127-18-4	Tetrachloroethene	4 - 8	4/8
NP	67-64-1	Acetone	4.6 - 11	3/8
4V	71-43-2	Benzene	4 - 36	2/8
73B	50-32-8	Benzo(a)pyrene	11	1/8

Notes:

NP = Non-priority pollutant

TABLE 1-6

SUMMARY OF SEDIMENT CONTAMINATION
CALDWELL TRUCKING COMPANY SITE

PP #	CAS #	Contaminant Name	Concentration Range (µg/kg)	Number of Occurrences/ Number of Samples
10V	75-34-3	1,1-Dichloroethane	9	1/11
23V	67-66-3	Chloroform	2	1/11
11V	71-55-6	1,1,1-Trichloroethane	2 - 5	2/11
30V	156-60-5	Trans-1,2-Dichloroethene	4 - 11	2/11
87V	79-01-6	Trichloroethene	2 - 39	3/11
85V	127-18-4	Tetrachloroethene	11	1/11
86V	108-88-3	Toluene	12	1/11
81B	85-01-8	Phenanthrene	430 - 500	2/11
78B	120-12-7	Anthracene	430	1/11
39B	206-44-0	Fluoranthene	500 - 830	2/11
84B	129-00-0	Pyrene	500 - 930	2/11
72B	56-55-3	Benzo(a)anthracene	490	1/11
76B	218-01-9	Chrysene	570	1/11
74B	205-99-2	Benzo(b)fluoranthene	430	1/11
75B	207-08-9	Benzo(k)fluoranthene	430	1/11
73B	50-32-8	Benzo(a)pyrene	430	1/11
83B	193-39-5	Ideno(1,2,3-cd)pyrene	430	1/11
79B	191-24-2	Benzo(g,h,i)perylene	430	1/11
93P	72-55-9	4,4'-DDE	5.8 - 230	3/11
94P	74-54-8	4,4'-DDD	11 - 160	3/11
110P	12672-29-6	Aroclor 1248	980	1/11
107P	11097-69-1	Aroclor 1254	4,100 - 12,258	2/11
66B	117-81-7	Bis(2-ethylhexyl)phthalate	1,700	1/11
NP	75-15-0	Carbon disulfide	2	1/11

Notes:

NP = Non-priority pollutant

- Contaminated groundwater discharge is not currently or expected to significantly affect water quality in the Passaic River.

- Air emissions from the site were observed during lagoon area soil boring operations. Air sampling and monitoring indicated that, undisturbed, the site poses little threat of air contamination. However, excavation of contaminated materials could lead to air emissions of site contaminants.

- The major health risk at the site is associated with ingestion or domestic use of contaminated groundwater. Although there are no data that indicate the human receptors in the plume are currently exposed to significant levels of contaminants in drinking water, any receptor in the vicinity of the site may be exposed at some future time, as a result of localized pumping influences or dispersion of the contaminant plume.

- Direct contact with, or accidental ingestion of, contaminated onsite surface soils may be associated with chronic and carcinogenic health risks. Exposure to offsite surface water and sediment in the unnamed tributaries of Deepavaal Brook is also of a concern.

- Environmental receptors (biota) may be affected by the site. Inorganic compounds are the primary contaminants of concern for aquatic biota. PCBs and lead in onsite and offsite surface soils and sediments could potentially affect terrestrial biota.

1.4 Data Limitations and Assumptions

As in any investigative effort that requires the collection of large amounts of data, circumstances and constraints often lead to limitations in the data base that require specific assumptions and approaches to overcome. To address the data limitations for this project, it will be useful to consider four basic areas of concern at the Caldwell Trucking Company Site. These include (1) Municipal Well No. 7, (2) the downgradient contaminant plume, (3) contaminated offsite surface water and sediments, and (4) onsite wastes and contaminated soils. Each of these areas of concern is discussed individually below.

1.4.1 Municipal Well No. 7

The extensive geologic and hydrologic investigation performed at the site has provided a very good understanding of the relationship between the site and Municipal Well No. 7. However, the complexity of the hydrologic system lends itself to slightly different interpretations of the data base and differing opinions as to the precise nature of the relationship between contamination currently in Well No. 7 and contamination at the site. In spite of these differences, there are several key points on which there is basic agreement. These are as follows:

- During the Well No. 7 aquifer test, the hydraulic gradient was reversed from the site toward Well No. 7.
- When Well No. 7 pumps, at 390 gallons per minute, groundwater flow is from the site toward Well No. 7.
- It is possible that the contaminants currently at Well No. 7 are from the site.
- It is also possible that the contaminants currently at Well No. 7 are from a totally different source.
- There is a potential for contaminants from the site to contaminate Well No. 7. Accordingly, there is a potential for contaminants from the site to contaminate Well No. 7 until such time as the site can be effectively controlled.

Based on these considerations, an alternative to return Well No. 7 to production will be included as part of this Feasibility Study Report. The alternative will focus on wellhead treatment and the evaluation will be based upon existing information on water treatability, treatment system design, and cost provided to NUS by the Township of Fairfield. This alternative will be part of Remedial Component 1 - Remediation of Municipal Well No. 7. The existing treatment system design and costs will be the only information used in formulating this alternative; other treatment methods and alternatives, such as drilling a new well in another location or aquifer renovation, will not be evaluated in this study. In addition, two other alternatives will be considered in this remedial component: No Action and Purchase of Water from Passaic Valley Water Commission.

The NJDEP currently is investigating potential sources for the contamination of Municipal Well No. 7. The results of this study will be useful in developing a comprehensive evaluation of remedial alternatives for Municipal Well No. 7.

1.4.2 The Downgradient Contaminant Plume

There are several data limitations relating to the downgradient contaminant plume that will require additional study and investigation before an effective remedial action for groundwater remediation can be developed. These include the hydraulic characteristics of the plume, the vertical and lateral extent of the plume, the treatability of the contaminated groundwater, and the location of other sources of contamination.

In lieu of performing additional RI studies in the plume area at this time, the NJDEP has suggested that this feasibility study consider providing an alternative water supply and sealing the private wells in the plume area as one remedial alternative. Such an alternative will adequately protect public health by minimizing exposure to contaminated groundwater.

The alternative discussed herein will be part of Remedial Component 2 - Remediation of the Downgradient Contaminant Plume. The alternative will consist of connecting residences to the Fairfield Township municipal water supply and sealing the private wells in the area to prevent domestic potable and nonpotable uses of the groundwater. It should be pointed out that there may be legal issues regarding the right of the Federal, state, or local governments to seal the privately owned wells in the plume area. Resolution of these issues may affect implementation of this alternative and should be investigated further. Other options for alternative water supply will not be considered for this Remedial Component in this study.

1.4.3 Offsite Surface Water and Sediment

Contamination was detected in most of the offsite surface water and sediment samples. While contamination at several locations is probably related to the site, the other locations could not have been affected by the site. Therefore, it has been concluded that sources other than the Caldwell Trucking Company Site are contributing to the widespread offsite surface water and sediment contamination in the vicinity of the site. The only area near the site that is considered to be influenced by contaminated runoff from the site is the unnamed tributary to Deepavaal Brook. The reach of concern of this tributary is shown in Figure 1-2.

Evaluation of remedial measures for these offsite areas will require additional RI studies aimed at determining the extent of contamination and identifying the sources of contamination. The Caldwell Trucking Company Site is certainly one of the sources of offsite surface water and sediment contamination in the area. However, remediating the offsite areas may not be effective if the other sources are not identified and controlled. Therefore, remedial measures for offsite surface waters and sediments in this feasibility study will be confined to minimizing further migration of contaminated materials from the site to the offsite surface waters and sediments. These measures will be considered with the measures for remediating the onsite contaminated materials discussed in the next subsection.

1.4.4 Onsite Wastes and Contaminated Soils

The existing and former waste disposal areas and areas of surface soil contamination have been well defined in the onsite investigations conducted in the RI (Figure 1-2). The former disposal areas have been designated as the Central and

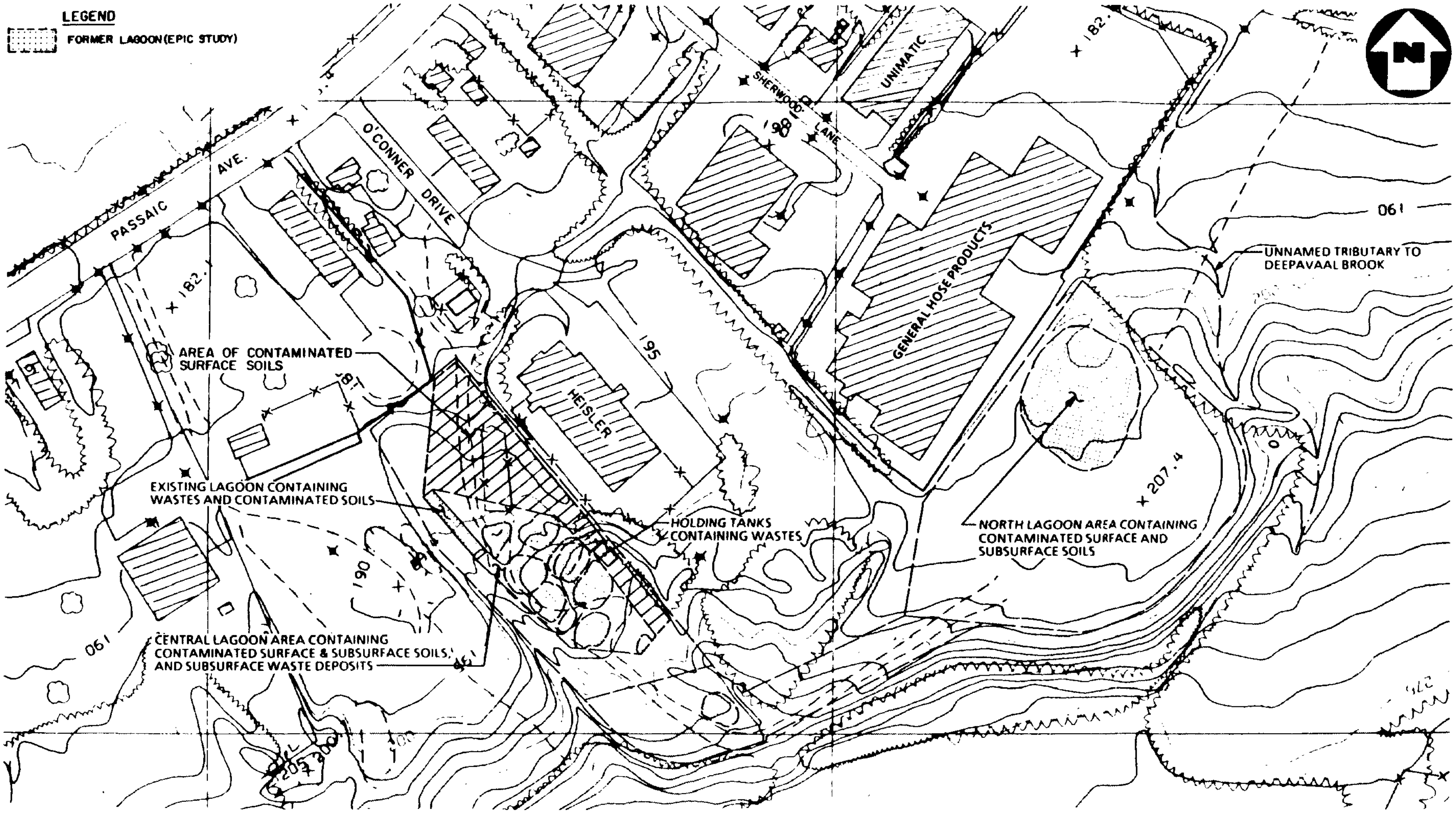


FIGURE 1-2

SITE LAYOUT

CALDWELL TRUCKING CO. SITE, FAIRFIELD TWP., NJ

0 150 300
SCALE IN FEET

NUS CORPORATION
A Halliburton Company

CTC 001 1121

North Lagoon Areas, shown in Figure 1-2, and are considered the primary source areas for groundwater contamination on the site. The areas surrounding these areas may be contaminated because of lateral migration of wastes and contaminated liquids in the unsaturated zone during and subsequent to disposal activities at the site. These areas may be secondary sources that may continue to contribute contaminants to the groundwater via infiltration and leaching after the primary source areas are remediated.

There is also reason to believe that contaminated surface and subsurface soils exist on contiguous properties, such as General Hose Products, Inc., Heisler Machine Tool, and possibly others. While General Hose Products Inc. is a known source of groundwater contamination, an investigation of the other sites would be needed to determine whether they are, in fact, additional sources of (contributors to) groundwater contamination.

NUS has attempted to estimate the extent of migration from the Central and North Lagoon Areas to the adjacent areas, based upon theoretical considerations of advancement of the wetted front in the unsaturated zone beneath an unlined impoundment. The results of the estimation indicated that a more direct method of determining the extent of migration from the source areas is necessary. Additional subsurface investigations should be performed as part of the Remedial Design phase of this project. NUS provides herein the criteria needed to establish the level of remediation of these soils and will screen technologies that may be used to achieve the level of remediation. Any changes in cost due to changes in the amount of material to be handled in the remedial action will be considered by increasing the volume for excavation and disposal. Therefore, for baseline costing purposes the quantity of contaminated subsurface materials will be based upon the amount of material contained in the Central and North Lagoon.

Alternatives dealing with onsite wastes and contaminated soils will be designated as Remedial Component 3 - Remediation of Onsite Wastes and Contaminated Soils. This remedial component will also address concerns related to contamination of offsite surface waters and sediments mentioned in the previous subsection.

1.5 Identification of Pathways of Exposure and Routes of Migration

For the purposes of this study, pathways of exposure refer to the routes by which environmental or human receptors may be exposed to contamination in the site area. Routes of migration refer to the routes by which contaminants are transported from the site to offsite areas or from one environmental medium to another. The contaminant exposure pathways and migration routes of concern can be described as follows:

- Surface Water Runoff - Transport of contaminated solids to offsite surface water and sediments.

- Groundwater - Continued leaching of source materials and migration of contaminated groundwater to downgradient human receptors; potential migration to Well No. 7 when in service.

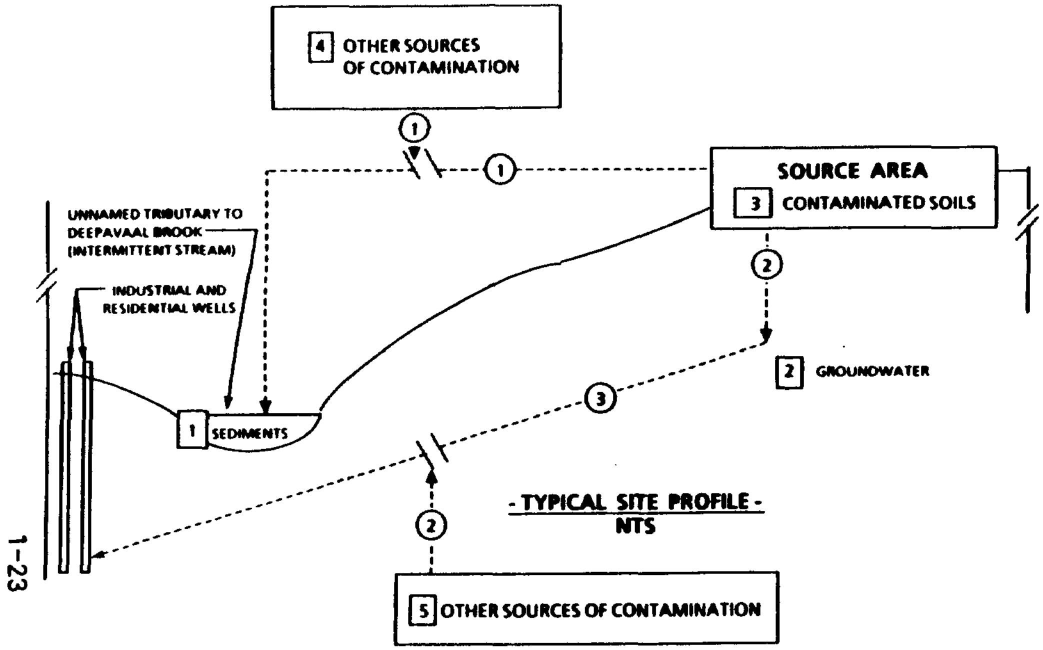
- Air - Potential migration of volatile organics and particulates during remedial activities.

- Onsite Surface Soils and Wastes - Potential exposure to contaminated surface soils and wastes on site.

The exposure pathways and migraton routes are summarized in Figures 1-3 and 1-4. All of the pathways can be addressed through implementation of the remedial components discussed previously.

1.6 Remedial Action Objectives and Criteria

Table 1-7 summarizes the objectives and criteria developed for the Caldwell Trucking Company Site. The objectives and criteria for each pathway or route are discussed in the following sections.



CONTAMINATION SUMMARY

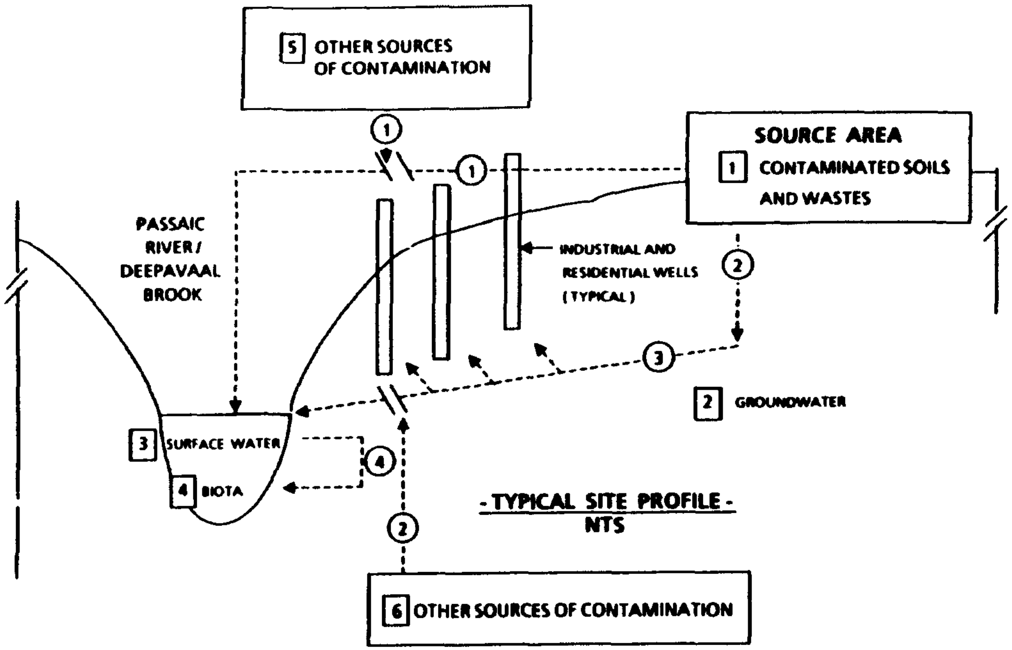
EXPOSURE PATHWAY	PRESENT RISK	CONTAMINANT MIGRATION ROUTES
1 SEDIMENTS		(1) SURFACE WATER RUNOFF & SOIL TRANSPORT
• DERMAL CONTACT - PUBLIC	6.7×10^{-5} to 4.0×10^{-3}	
• INGESTION - HUMAN	5.1×10^{-6} to 1.8×10^{-3}	
2 GROUNDWATER		(2) LEACHING OF CONTAMINANTS FROM SOILS
• INGESTION - HUMAN	5.5×10^{-6} to 1.4×10^{-2}	(3) GROUNDWATER DISCHARGE
• INHALATION OF OFF GASES - HUMAN	8.6×10^{-6} to 2.6×10^{-2}	
3 CONTAMINATED SOILS		(1) SURFACE WATER RUNOFF & SOIL TRANSPORT
• DERMAL CONTACT - PUBLIC	1.7×10^{-6} to 1.5×10^{-4}	(2) LEACHING OF CONTAMINANTS FROM SOILS
• INGESTION - HUMAN	1.4×10^{-7} to 6.3×10^{-5}	
4 5 OTHER SOURCES	NOT QUANTIFIED	(1) SURFACE WATER RUNOFF & SOIL TRANSPORT; (2) LEACHING OF CONTAMINANTS FROM SOILS

LEGEND

1 DENOTES EXPOSURE PATHWAY NO. 1

(1) DENOTES CONTAMINANT MIGRATION PATHWAY NO. 1

FIGURE 1-3
CONTAMINANT EXPOSURE PATHWAYS AND MIGRATION ROUTES SUMMARY, NORTH LAGOON AREA
CALDWELL TRUCKING COMPANY SITE, FAIRFIELD TWP., NJ



LEGEND

1 DENOTES EXPOSURE PATHWAY NO. 1

(1) DENOTES CONTAMINANT MIGRATION PATHWAY NO. 1

CONTAMINATION SUMMARY

EXPOSURE PATHWAY	PRESENT RISK	CONTAMINANT MIGRATION ROUTES
1 CONTAMINATED SOILS AND WASTES • DERMAL CONTACT – PUBLIC • INGESTION – HUMAN	 6.8×10^{-5} to 2.7×10^{-2} 5.3×10^{-4} to 1.2×10^{-2}	(1) SURFACE WATER RUNOFF & SOIL TRANSPORT (2) LEACHING OF CONTAMINANTS FROM SOILS
2 GROUNDWATER • INGESTION – HUMAN • INHALATION OF OFF-GASES – HUMAN	 5.5×10^{-6} to 1.4×10^{-2} 8.6×10^{-6} to 2.6×10^{-2}	(2) LEACHING OF CONTAMINANTS FROM SOILS (3) GROUNDWATER DISCHARGE
3 SURFACE WATER & SEDIMENTS • DERMAL CONTACT – PUBLIC • INGESTION – HUMAN	 3.1×10^{-11} to 5.1×10^{-8} 6.6×10^{-11} to 3.4×10^{-6}	(1) SURFACE WATER RUNOFF & SOIL TRANSPORT (3) GROUNDWATER DISCHARGE
4 BIOTA • INGESTION – HUMAN	 3.5×10^{-6} to 9.8×10^{-5}	(4) BIOTA UPTAKE OF CONTAMINANTS
5 6 OTHER SOURCES	NOT QUANTIFIED	(1) SURFACE WATER RUNOFF & SOIL TRANSPORT (2) LEACHING OF CONTAMINANTS FROM SOILS

FIGURE 1-4

CONTAMINANT EXPOSURE PATHWAYS AND MIGRATION ROUTES SUMMARY, CENTRAL LAGOON AREA
CALDWELL TRUCKING COMPANY SITE, FAIRFIELD TWP., NJ

TABLE 1-7

POTENTIAL REMEDIAL ACTION OBJECTIVES AND TARGET CLEANUP CRITERIA
CALDWELL TRUCKING COMPANY SITE

Pathway/Receptor	Current Risk Level	Potential Objectives	Criteria	General Response Actions
1. Offsite surface water, sediments and runoff/environment (brooks, river, swampy areas, biota), public recreation, casual contact of public.		Prevent an increase in contaminant levels in offsite surface water and sediments due to runoff from the site.	Maintain existing or lower concentrations in offsite surface water and sediments. Set action levels for the surface water and groundwater runoff migration routes.	Containment of contaminated surface soils. Diversion of surface water. Removal of contaminated surface soils with treatment or disposal. Collection of runoff.
a. Dermal contact with surface water in Deepavaal Brook and Passaic River.	a. 3.1×10^{-11} to 5.1×10^{-8}		Surface water runoff migration route from surface soils in north lagoon area, based on the worst of the dermal or ingestion risks. Target soil concentrations will correspond to 10^{-6} risk level. See Table 1-8, Nos. 1 and 2.	
b. Ingestion of surface water from Deepavaal Brook and and Passaic River.	b. 6.6×10^{-11} to 3.4×10^{-6}			
c. Ingestion of fish from Deepavaal Brook and Passaic River.	c. 3.5×10^{-6} to 9.8×10^{-5}			
d. Dermal contact with sediments in unnamed tributaries to Deepavaal Brook	d. 6.7×10^{-5} to 4.0×10^{-3}			
e. Inadvertent ingestion of sediments in unnamed tributaries to Deepavaal Brook.	e. 5.1×10^{-6} to 1.8×10^{-3}			

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TABLE 1-7
POTENTIAL REMEDIAL ACTION OBJECTIVES AND TARGET CLEANUP CRITERIA
CALDWELL TRUCKING COMPANY SITE
PAGE TWO

Pathway/Receptor	Current Risk Level	Potential Objectives	Criteria	General Response Actions
2 Onsite surface soils and wastes/ casual intruders, environment (biota).		Reduce contaminant levels in soils and wastes	Set action levels based on the worst of dermal and ingestion risks. Target soil/waste concentration will correspond to 10^{-6} risk. See Table 1-8, Nos. 3 and 4.	In-situ treatment of surface soils/wastes. Removal of contaminated soils/wastes with treatment or disposal.
a. Dermal contact and inadvertent ingestion of surface soils.	a.* 6.1×10^{-6} to 1.2×10^{-2}			
b. Dermal and inadvertent ingestion of wastes.	b. 5.3×10^{-6} to 3.7×10^{-3}	Reduce direct contact with contaminated soils and wastes.	Set action levels based on the worst of dermal and ingestion risks. Target soil/waste concentration will correspond to 10^{-6} risk. See Table 1-8, Nos. 3 and 4.	Restrict access to contaminated soils/ wastes. Containment of soils/wastes.
3. Groundwater/industrial wells, residential wells (drinking water), environment (river biota), Municipal Well No. 7		Prevent an increase in contaminant levels in groundwater.	Maintain existing level or lower of groundwater contamination.	Alternative drinking water supply. Drinking water treatment.
a. Ingestion of groundwater in plume area	a. 5.5×10^{-6} to 1.4×10^{-2}	Reduce contaminants in groundwater.	Action levels based on risk 10^{-6} in groundwater; target groundwater concentration will determine target soil concentrations. (Table 1-7, Nos. 5 and 7).	Containment of leachate. Containment of soils/wastes with groundwater monitoring. Removal of soils/waste with treatment or disposal.
b. Inhalation of offgases from water in plume area.	b. 8.6×10^{-6} to 2.6×10^{-2}			
c. Ingestion of groundwater in Well No. 7	c. 9.3×10^{-4} to 1.1×10^{-3}		Action levels based on MCLs and other relevant criteria. Target groundwater concentrations will determine target soil concentrations (Table 1-8, No. 6 and 8).	In-situ treatment of soils/wastes. Alternative drinking water supply in plume area. Drinking water treatment at Well No. 7.

*Considers risks based on contamination over the entire site.

TABLE 1-7
POTENTIAL REMEDIAL ACTION OBJECTIVES AND TARGET CLEANUP CRITERIA
CALDWELL TRUCKING COMPANY SITE
PAGE THREE

Pathway/Receptor	Current Risk Level	Potential Objectives	Criteria	General Response Actions
4. Air emissions during remediation/ adjacent population.		N/A	N/A	N/A
a. Volatile organics	a. 4.9×10^{-7}			
b. Particulates	b. 4.1×10^{-8}			

1.6.1 Offsite Surface Water, Sediments, and Runoff

Surface and subsurface runoff from the site are transporting contaminants from the site area to downslope points on and adjacent to the site. The contribution of runoff loading to contamination of downslope points has not been quantified, since additional unidentified sources also contaminate these areas. Thus, elimination of the runoff pathway will prevent an increase in the contamination in downslope points.

To meet this "Prevent an Increase" (see Table 1-7) objective, target cleanup criteria can be established for the onsite sources that contribute to offsite areas where risk levels greater than 10^{-6} were found. As indicated in Section 1.4.3 and in Table 1-7, the offsite area of concern, from a risk perspective, is the sediments in the unnamed tributary to Deepavaal Brook. This tributary is shown in Figure 1-2. The area of the site that is contributing to this area is the North Lagoon Area, shown in Figure 1-2. Risk-based target cleanup criteria have been established for the surface water runoff migration route for this pathway. They are summarized in Table 1-8. These action levels correspond to the concentration of a hazardous contaminant that can remain in the surface soils of the North Lagoon Area which will not result in a risk greater than 10^{-6} in the offsite area via dermal exposure or accidental ingestion of the contaminated sediments that have migrated from the site. The leaching of contaminated soils and groundwater migration will be addressed under the report subsection describing groundwater as a contaminant exposure pathway (Section 1.6.3).

1.6.2 Onsite Surface Soils and Wastes

Contaminated surface soils and wastes on site pose a threat to public health via two routes of exposure: dermal contact and accidental ingestion. These risks can be reduced to acceptable levels in two ways: by reducing the levels of contaminants in the soils to levels that correspond to a risk of $<10^{-6}$, or by preventing direct contact with contaminated material with levels corresponding to $>10^{-6}$ risk (see Table 1-7). Since each objective will protect public health and

TABLE 1-8

SOIL ACTION LEVELS
CALDWELL TRUCKING COMPANY STIE

	Pathway/Receptor	Potential Objectives	Soil Action Level (ug/kg)		Maximum Soil or Waste Concentration (ug/kg)
1	Dermal Contact with sediments in unnamed tributary of Deepavaal Brook	Prevent an increase in contaminant levels in offsite sediments due to surface runoff from the site; 1 x 10^{-6} total lifetime cancer risk.	tetrachloroethene(2) trichloroethene(2) total PCBs(1)	135-1,887 677-9,433 NC	5 5 420*
2	Accidental ingestion of sediments in unnamed tributary of Deepavaal Brook	Prevent an increase in contaminant levels in offsite sediments due to surface runoff from the site; 1 x 10^{-6} total lifetime cancer risk for PCBs and 1 x 10^{-6} total lifetime cancer risk for the remaining compounds.	tetrachloroethene(3) trichloroethene(3) total PCBs(4)	326-24,039 1,629-120,195 200	5 5 420*
3	Dermal contact with onsite surface soils and wastes	Reduce contaminant levels in soils and wastes; 1 x 10^{-6} total lifetime cancer risk(5).	tetrachloroethene(2) trichloroethene(2) chloroform(2) vinyl chloride(2) benzene(2) total PCBs(1)	54-755 271-3,773 46-647 186-2,587 112-1,561 NC	1,300 7,500* 5,800* 32 180 92 76,000*
4	Accidental ingestion of onsite surface soils and wastes	Reduce contaminant levels in soils and wastes; 1 x 10^{-6} total lifetime cancer risk for PCBs and 1 x 10^{-6} total lifetime cancer risk for the remaining compounds.(5)	tetrachloroethene(3) trichloroethene(3) chloroform(3) vinyl chloride(3) benzene(3) total PCBs	130-9,616 651-48,078 112-8,242 447-32,968 270-19,894 200	1,300 7,500 5,800 32 180 92 76,000*

TABLE 1-8
SOIL ACTION LEVELS
CALDWELL TRUCKING COMPANY SITE
PAGE TWO

Pathway/Receptor		Potential Objectives	Soil Action Level (ug/kg)		Maximum Soil or Waste Concentration (ug/kg)
5	Ingestion of groundwater	Reduce contaminants in groundwater - Central Lagoon; 1 x 10^{-6} cancer risk at the receptor location.	trichloroethene	79	790,000*
			tetrachloroethene	51	840,000*
			chloroform	4	14,000*
			1,1-dichloroethene	9	160*
			total PAHs	351	330(6)*
			n-nitrosodimethylamine	2.1 x 10^{-3}	410*
			4,4' DDT	17,310	120
			benzene	22	92*
			vinyl chloride	36	180*
			total PCBs	57	360,000*
6	Ingestion of groundwater	Reduce contaminants in groundwater - Central Lagoon; target concentrations at the receptor location, based on MCLs, SNARLs, or AWQC, and consider additive effects.	1,1,1-trichloroethane	1.3	240 mg/kg
			xylenes	35 mg/kg	280 mg/kg*
			fluoranthene	1,543 mg/kg	4.8 mg/kg
			ethylbenzene	68 mg/kg	66 mg/kg
			diethyl phthalate	5,190 mg/kg	0.330 mg/kg
			toluene	14 mg/kg	94 mg/kg*
			1,1-dichloroethane	20 mg/kg	30 mg/kg*
			1,2-trans-dichloroethane	1.3 mg/kg	21 mg/kg*
			bis(2-ethylhexyl)phthalate(7)	9,154 mg/kg	9 mg/kg
			1,3-dichlorobenzene	82 mg/kg	6.8 mg/kg
			1,4-dichlorobenzene	92 mg/kg	16 mg/kg
			1,2-dichlorobenzene	75 mg/kg	44 mg/kg
			napthalene	59 mg/kg	3.1 mg/kg
			phenol	3.6 mg/kg	15 mg/kg*
			di-n-butyl phthalate	5,407 mg/kg	0.308 mg/kg
			chlorobenzene	2.9 mg/kg	0.009 mg/kg
			acenapthene	24 mg/kg	2.8 mg/kg
			1,2,4-trichlorobenzene	725 mg/kg	3.4 mg/kg

TABLE 1-8
SOIL ACTION LEVELS
CALDWELL TRUCKING COMPANY SITE
PAGE THREE

	Pathway/Receptor	Potential Objectives	Soil Action Level (ug/kg)		Maximum Soil or Waste Concentration (ug/kg)
7	Ingestion of groundwater	Reduce contaminants in groundwater - North Lagoon; 1 x 10^{-6} total lifetime cancer risk at the receptor location.	trichloroethene	468.4	100
			tetrachloroethene	300	24
			total PCBs	522	520
8	Ingestion of groundwater	Reduce contaminants in groundwater - North Lagoon; target concentrations at the receptor location, based on MCLs, SNARLs, or AWQC, and consider additive effects.	ethylbenzene	255 mg/kg	0.0077 mg/kg
			xylenes	134.2 mg/kg	0.002 mg/kg
			toluene	52 mg/kg	0.0087 mg/kg
			naphthalene	208 mg/kg	1.1 mg/kg
			acenapthene	145 mg/kg	0.180 mg/kg
			bis(2-ethylhexyl)phthalate	34,379 mg/kg	0.530 mg/kg
			fluoranthene	5,735 mg/kg	0.820 mg/kg
			trans-1-2-dichloroethene	4.6 mg/kg	0.005 mg/kg

Notes:

(1) Insufficient information is available on the dermal absorption of PCBs; consequently action levels were not calculated (NC).

(2) The lower value assumes a lifetime soil accumulation of 110,000 g (Schaum, 1984). The upper value assumes a lifetime soil accumulation of 7,900 g (Schaum, 1984).

(3) The lower value assumes ingestion of 5 grams of soil per day (considers pica behaviors) (Schaum, 1984). The upper value assumes ingestion of 0.1 grams of soil per day (Schaum, 1984).

(4) EPA Interim PCB Soil Action Level. Considers chronic exposure via accidental ingestion and inhalation of volatilized PCBs.

(5) Assumes polycyclic aromatic hydrocarbons (PAHs) will be removed to background levels.

(6) Maximum concentration of benzo(a)pyrene.

(7) Does not consider carcinogenic effects of bis(2-ethylhexyl)phthalate

* Indicates levels on site that exceed action levels. See Figure 1-6 for areas on site where contaminant levels exceed action levels.

Appendix B presents the assumptions and calculations used to derive these action levels.

the environment, the response actions for each will be retained for further consideration. The soil action levels that correspond to 10^{-6} risk through dermal exposure or accidental ingestion are shown in Table 1-8.

1.6.3 Groundwater

It was demonstrated in the RI (Section 8.0) that contaminated groundwater discharge to the Passaic River does not have a significant effect on contaminant levels in the river. Therefore, industrial and residential groundwater users between the site and the river are the primary receptors of contamination via the groundwater pathway. As can be seen in Table 1-7 and as indicated in Section 1.4, protection of public health can be achieved by meeting the objective of preventing an increase in contaminant levels by providing an alternative water supply in the plume area and by providing drinking water treatment at Municipal Well No. 7. On the other hand, achieving the objective of reducing contaminants in the groundwater will protect public health as well as remediate the contaminant sources on the site (see Table 1-7, General Response Actions). The result will be some improvement in groundwater quality over time. Therefore, the objective of reducing contaminant concentrations in groundwater is the appropriate objective for the groundwater pathway.

The remediation criteria to achieve the risk level of 10^{-6} through ingestion of groundwater downgradient of the site are shown as soil action levels in Table 1-8. These are concentrations that, if left in the soil, will not leach into the groundwater at concentrations which will result in a risk of $>10^{-6}$ to downgradient receptors at the first residential location (approximately 1,000 feet). However, groundwater leaving the site may not satisfy requirements for groundwater protection in Class II aquifers (see Section 2.1.3 for an explanation of EPA's policy on groundwater protection). Soil action levels associated with these criteria (i.e., cleaning to drinking water quality, alternate concentration limits (ACLs) or background) were unrealistically low and may not be technically feasible on a site where subsurface soil contamination may extend far beyond the property boundaries.

1.6.4 Air Emissions During Remediation

The predicted risk to the surrounding population from air emissions of volatile organics or particulates is not expected to be a problem. As indicated in Table 1-7, the predicted risk to the public from emissions of volatiles and particulates is $<10^{-6}$. Therefore, response actions to limit releases are not necessary.

1.6.5 Summary of Action Levels and Distribution of Onsite Soil Contaminants

Figure 1-5 depicts the areas on site where contaminant levels exceed the action levels given in Table 1-8. Table 1-9 provides a detailed comparison of the onsite contamination and the action levels (background concentration ranges for inorganics) and demonstrates that both organic and inorganic contamination are of concern for onsite surface and subsurface soils.

A comparison of average soil concentrations instead of maximum soil concentrations with action levels indicates fewer contaminants exceeding the 10^{-6} action levels; a comparison of average concentrations with 10^{-4} action levels indicates even fewer contaminants of concern. However, it is clear that there are a number of contaminants that exceed even the 10^{-4} action levels and background ranges (for metals) by a significant degree.

Considering these contaminant levels, the toxic or carcinogenic effects of some of the most abundant contaminants, and the uncertainties inherent in the sampling and analysis program in determining the distribution of the contaminants in the subsurface soils, it will be prudent to consider that, for the purposes of remedial actions aimed at the subsurface soils, the concentrations of contaminants may be higher than the calculated averages and, conservatively, they should be considered as uniformly distributed in the subsurface.

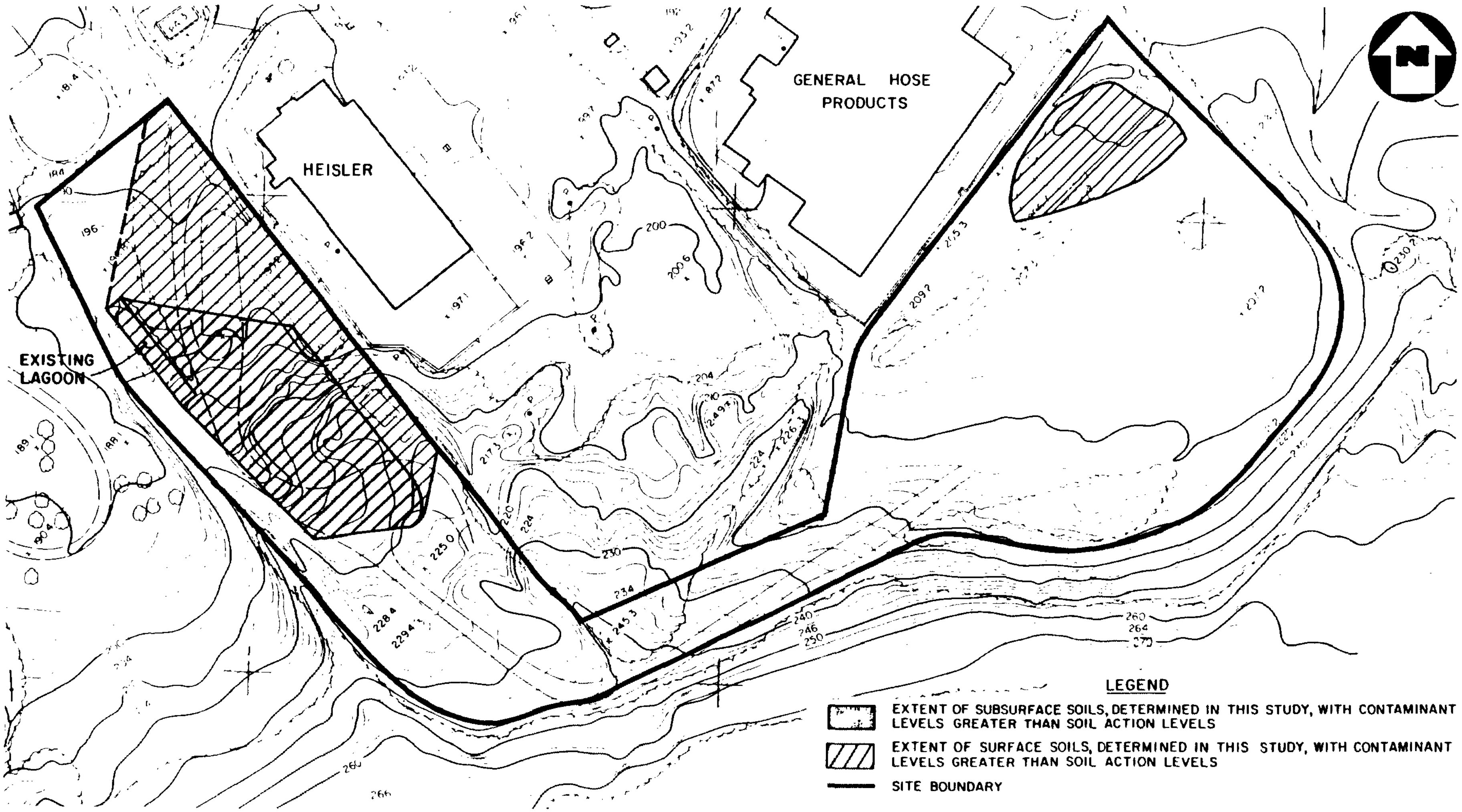

FIGURE 1-5

100 0 100
SCALE IN FEET

NUS CORPORATION
A Halliburton Company

ONSITE AREAS WITH SOIL CONTAMINATION EXCEEDING SOIL ACTION LEVELS
CALDWELL TRUCKING CO. SITE, FAIRFIELD TWP., NJ

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TABLE 1-9

COMPARISON OF SITE SOIL CONTAMINANTS AND ACTION LEVELS FOR REMEDIATION
CALDWELL TRUCKING COMPANY SITE

Contaminant	Max. Conc. in Soil (µg/kg)	Avg. Conc. in Soil µg/kg)	Range of Background Conc.[1] (mg/kg)	10^{-4} Action Levels[2] (µg/kg)	10^{-6} Action Levels[2] (µg/kg)	Action Levels Based on Applicable & Relevant Standards (µg/kg)	Comments
1. Dermal contact with sediments in unnamed tributary of Deepavaal Brook							
PCBs (total)	420	280	-	-	-	-	-
2. Accidental ingestion of sediments in unnamed tributary of Deepaval Brook							
PCBs (total)	420	280	-	20,000	200	-	Average concentration exceeds 10^{-6} action level by factor of 1.4
3. Dermal contact with onsite surface soils and wastes							
trichloroethene	5,800	228	-	377,300	3,773	-	-
tetrachloroethene	7,500	327	-	75,500	755	-	-
PCBs (total)	76,000	4,254	-	-	-	-	-
4. Accidental ingestion of onsite surface soils and wastes							
PCBs (total)	76,000	4,254	-	20,000	200	-	Average concentration exceeds 10^{-6} action level by factor of 21
arsenic (mg/kg)	3,905	252	0.1-40	-	-	-	Average concentration exceeds background range by factor of 6

TABLE 1-9
COMPARISON OF SITE SOIL CONTAMINANTS AND ACTION LEVELS FOR REMEDIATION
CALDWELL TRUCKING COMPANY SITE
PAGE TWO

Contaminant	Max. Conc. in Soil (µg/kg)	Avg. Conc. in Soil µg/kg)	Range of Background Conc.[1] (mg/kg)	10^{-4} Action Levels[2] (µg/kg)	10^{-6} Action Levels[2] (µg/kg)	Action Levels Based on Applicable & Relevant Standards (µg/kg)	Comments
4. Accidental ingestion of onsite surface soils and wastes (continued)							
barium (mg/kg)	20,445	1,630	100-3,000	-	-	-	-
cadmium (mg/kg)	43	9.8	0.01-3	-	-	-	Average concentration exceeds background range by factor of 14
chromium (mg/kg)	186	42	5-3,000	-	-	-	-
lead (mg/kg)	144,902	9,534	100-200	-	-	-	Average concentration exceeds background range by factor of 48
manganese (mg/kg)	666	387	100-4,000	-	-	-	-
mercury (mg/kg)	3.6	0.8	0.01-1	-	-	-	Average concentration exceeds background range by factor of 2.6
nickel (mg/kg)	159	21	10-1,000	-	-	-	-
5. Groundwater ingestion; carcinogenic compounds							
trichloroethene	790,000	60,827	-	7,900	79	-	Average concentration exceeds 10^{-4} action level by factor of 7.7
tetrachloroethene	840,000	28,020	-	5,100	51	-	Average concentration exceeds 10^{-4} action level by factor of 5.5

TABLE 1-9
COMPARISON OF SITE SOIL CONTAMINANTS AND ACTION LEVELS FOR REMEDIATION
CALDWELL TRUCKING COMPANY SITE
PAGE THREE

Contaminant	Max. Conc. in Soil (µg/kg)	Avg. Conc. in Soil µg/kg)	Range of Background Conc.[1] (mg/kg)	10^{-4} Action Levels[2] (µg/kg)	10^{-6} Action Levels[2] (µg/kg)	Action Levels Based on Applicable & Relevant Standards (µg/kg)	Comments
5. Groundwater ingestion; carcinogenic compounds (continued)							
chloroform	14,000	520	-	400	4	-	Average concentration exceeds 10^{-4} action level by factor of 1.3
1,1-dichloroethene	160	5	-	900	9	-	-
benzene	92	3.2	-	2,200	22	-	-
vinyl chloride	180	4.5	-	3,600	36	-	-
PCBs (total)	360,000	28,152	-	5,740	57.4	-	Average concentration exceeds 10^{-4} action level by factor of 5
4,4'-DDT	28,000	3	-	1,731,000	17,310	-	-
N-nitrosodimethyl-amine	410	10.3	-	0.21	0.0021	-	Average concentration exceeds 10^{-4} action level by factor of 49
PAHs (total)[3]	8,900	908	-	35,100	351	-	-
6. Groundwater ingestion; noncarcinogenic compounds							
xylenes	280,000	9,303	-	-	-	35,000	-
toluene	94	-	-	1,400	14	-	-
fluoranthene	4,800	250	-	-	-	1,543,000	-
ethyl benzene	66,000	2,208	-	-	-	68,000	-

TABLE 1-9
COMPARISON OF SITE SOIL CONTAMINANTS AND ACTION LEVELS FOR REMEDIATION
CALDWELL TRUCKING COMPANY SITE
PAGE FOUR

Contaminant	Max. Conc. in Soil (µg/kg)	Avg. Conc. in Soil (µg/kg)	Range of Background Conc.[1] (mg/kg)	10^{-4} Action Levels[2] (µg/kg)	10^{-6} Action Levels[2] (µg/kg)	Action Levels Based on Applicable & Relevant Standards (µg/kg)	Comments
diethyl phthalate	330	8.3	-	-	-	-	-
toluene	94,000	6,452	-	-	-	14,000	-
1,1-dichloroethane	30,000	914	-	-	-	20,000	-
t-1,2-dichloroethane	21,000	1,034	-	-	-	1,300	-
BEHP	9,000	368	-	-	-	9,154,000	-
1,3-dichlorobenzene	2,400	107	-	-	-	82,000	-
1,4-dichlorobenzene	16,000	669	-	-	-	92,000	-
1,2-dichlorobenzene	44,000	1,610	-	-	-	75,000	-
1,2,4-trichloro-benzene	3,400	93	-	-	-	725,000	-
1,1,1-trichloroethane	240,000	12,683	-	-	-	1,300	Average concentration exceeds action level by factor of 9.8
phenol	15,000	782	-	-	-	3,600	-
arsenic (mg/kg)	3,905	159	0.1-40	-	-	-	Average concentration exceeds background range by factor of 4
barium (mg/kg)	20,445	1,480	100-3,000	-	-	-	-
cadmium (mg/kg)	43	7.5	0.01-3	-	-	-	Average concentration exceeds background range by factor of 11
chromium (mg/kg)	88	34	5-3,000	-	-	-	-
lead (mg/kg)	144,902	10,843	100-200	-	-	-	Average concentration exceeds background range by factor of 54

TABLE 1-9
COMPARISON OF SITE SOIL CONTAMINANTS AND ACTION LEVELS FOR REMEDIATION
CALDWELL TRUCKING COMPANY SITE
PAGE FIVE

Contaminant	Max. Conc. in Soil (µg/kg)	Avg. Conc. in Soil µg/kg)	Range of Background Conc.[1] (mg/kg)	10^{-4} Action Levels[2] (µg/kg)	10^{-6} Action Levels[2] (µg/kg)	Action Levels Based on Applicable & Relevant Standards (µg/kg)	Comments
manganese (mg/kg)	8,100	819	100-4,000	-	-	-	-
mercury (mg/kg)	12	0.8	0.01-1	-	-	-	Average concentration exceeds background range by factor of 2.6
nickel (mg/kg)	640	26	10-1,000	-	-	-	-

NOTES:

1 Only applicable to inorganics, for which values were used from NJDEP, personal communication, Sophia Stockman, May 8, 1986, and literature values from Bowen, 1968. Organic compound concentrations were below detection limits in background samples.

2 Represents a range of concentrations corresponding to CERCLA remediation goals of 10^{-4} to 10^{-6} range of residual risk.

3 Total PAHs include benzo(a)pyrene, pyrene, benzo(b&k) fluoranthene, fluorene, and phenanthrene.

Therefore, remedial actions for the subsurface soils should consider solutions for the various contaminant types that exceed the stated action levels. For the purposes of this study, the action levels will correspond to the 10^{-6} risk level for carcinogenic compounds, the action levels based on applicable and relevant standards for noncarcinogenic compounds, and the high range of the background concentrations for the inorganics. These action levels are shown in Table 1-9.

2.0 SCREENING OF REMEDIAL ACTION TECHNOLOGIES

A two-phased process is used to select the most appropriate remedial action alternatives for the Caldwell Trucking Company Site. First, an initial screening of technologies is required to eliminate from further consideration infeasible, inappropriate, or environmentally unacceptable technologies. The following sections describe the screening procedure and then identify the most promising technologies.

In the second phase, technologies that pass the screening are discussed individually or combined to form remedial alternatives. These remedial action alternatives are presented and evaluated in Sections 3.0 and 4.0.

2.1 Screening Criteria

The following criteria are assessed in the technology screening process:

- Technical
- Environmental and Public Health
- Institutional
- Cost

2.1.1 Technical Criteria

Site data are reviewed with respect to each technology to identify conditions that either promote or limit its use. If site characteristics clearly preclude the use of a particular technology, it is eliminated from consideration. Each technology is reviewed using the following factors:

Performance Standard

The effectiveness of the technology in satisfying the remedial objective for each contaminant pathway is evaluated. The technology must be durable and functional for a long-term period for the performance standard to be met.

Reliability Standard

The reliability of the technology to perform its intended function is evaluated. The requirements for operation of the technology are considered. In addition, the maintenance activities required to service the facility and ensure its continued performance are also appraised.

Implementability Standard

The site conditions are considered in determining the feasibility of implementing a particular remedial measure. The length of time required to implement the measure and to achieve the intended results is also evaluated, along with the most practical approaches to implementing the various steps necessary to complete each individual remedial alternative.

Safety Standard

The risk to workers, adjacent property, and the environment, associated with the implementation of the technology, is assessed.

2.1.2 Environmental and Public Health Criteria

The screening process also involves the evaluation of remedial action technologies, based on environmental and public health criteria. Each remedial technology is qualitatively evaluated in terms of the following factors:

- Potential public health and environmental impacts as a result of implementation of the technology, i.e., impacts occurring during the remedial action phase.

- The extent to which the technology remediates or minimizes the potential health hazards and the environmental impacts identified in Section 1.0.

Environmental Factors

Each technology is evaluated considering the objectives of the response and how it will alter contaminant transport pathways to the environment. The technologies are also evaluated based upon any adverse effects on the environment from construction-related impacts. Such impacts include air quality (volatilized and particulate contaminants), groundwater and surface-water quality, wetland quality, and soil and sediment quality.

Public Health Factors

The technologies are evaluated for their effectiveness in reducing the possible contaminant exposure to the public by air, groundwater, surface water, and soil and sediment pathways. In evaluating a technology, its effectiveness is judged by how well the contaminants are isolated from migration routes and exposure paths. The technologies are also evaluated based upon any adverse effects on the public from construction-related impacts.

2.1.3 Institutional Criteria

Institutional criteria refer to regulations that establish practice or performance standards applicable to the remediation of the Caldwell Trucking Company Site.

The following Federal and state regulations and guidelines are considered when screening remedial alternatives.

- Clean Water Act of 1948 (Amended 1972) - Governs point-source discharge through the National Pollutant Discharge Elimination System (NPDES), discharge of dredge or fill materials, and oil and hazardous spills to U.S. waters.

  Water quality criteria were developed for 64 pollutants in 1980 (45 FR 231) pursuant to Section 304(a)(1) of the Clean Water Act. In 1983, EPA revised nine criteria previously published in the "Red Book" (Quality Criteria for Water, 1976) and in the 1980 criteria documents. These criteria are not legally enforceable, but state standards developed using the Federal criteria are enforceable. In many cases, state standards do not include specific numerical limitations on priority pollutants. Where there is neither a state standard nor an MCL for a pollutants, the Federal Water Quality Criteria are relevant and should be considered.

- Clean Air Act of 1967 - Governs air emissions resulting from remedial actions. The Clean Air Act promulgated the National Ambient Air Quality Standards (NAAQS). NAAQS are available for six chemicals or groups of chemicals and for airborne particulates. The sources of the contaminant and the route of exposure were considered in the formulation of the standards. These standards do not consider the costs of achievement or the feasibility of implementation. The NAAQS allow for a margin of safety to account for unidentified hazards and effects.

- Resource Conservation and Recovery Act (RCRA) of 1976 (Amended 1984) - Governs generation, transportation, storage, and disposal of hazardous wastes.

  RCRA 40 CFR 264 standards were used for remedial actions including offsite hauling and disposal of hazardous wastes, onsite capping and landfilling, and groundwater monitoring. RCRA also provides guidance on establishment of alternate concentration limits (ACLs) for groundwater cleanup under 40 CFR 264.94.

- Groundwater Protection Strategy

EPA's policy is to protect groundwater for its highest present or potential beneficial use. This policy will be incorporated into future regulatory amendments. The strategy designates three categories of groundwater:

- Class 1 - Special Groundwaters - Waters that are highly vulnerable to contamination and are either irreplaceable or ecologically vital sources of drinking water.

- Class 2 - Current and Potential Sources of Drinking Water and Waters Having Other Beneficial Uses - Waters that are currently used or that are potentially available.

- Class 3 - Groundwater Not a Potential Source of Drinking Water and of Limited Beneficial Use - Waters that are saline or contaminated beyond reasonable use. They must not be connected to Class 1 or 2 waters or to surface waters in any way that could allow contaminant migration.

Cleanup criteria specified in the policy are as follows:

- Class 1 - Clean to meet drinking water standards at levels that protect human health.

- Class 2 - Clean to drinking water standards or ACLs. If neither of these is available, clean to background levels.

- Class 3 - No groundwater cleanup is required.

In certain situations involving current sources of drinking water, such as when technical feasibility is an issued, the cost-effective remedy may be to provide an alternative drinking water supply rather than restoring the contaminated aquifer.

- Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA or Superfund Legislation) - Governs identification of uncontrolled hazardous waste disposal sites and specifies a logical process for their assessment and the remediation of impacts to public health and the environment.

- Safe Drinking Water Act (SDWA) of 1974 - National Interim Primary Drinking Water Standards (NIPDWS) under the Safe Drinking Water Act are promulgated as Maximum Concentration Levels (MCLs), which represent the allowable levels in public water systems. As a matter of policy, CERCLA will also use them for other drinking water exposures. They are generally based on lifetime exposure to the contaminant for a 70-kg (154-pound) adult who consumes 2 liters (0.53 gallons) of water per day. The total environmental exposure to contaminants was generally considered in calculating specific MCLs. EPA estimated the amount of the substance to which the average person is likely to be exposed from all sources (air, food, water, etc.) and then determined the fraction of the total intake from drinking water.

- Toxic Substances Control Act of 1976 - The Toxic Substances Control Act (TSCA) provides authority to require testing of chemical substances entering the environment and to regulate them, where necessary. PCB regulation and enforcement are an important aspect of TSCA.

<u>PCB Requirements</u>

40 CFR 761 establishes regulations for manufacturing, processing, distribution in commerce, and use prohibitions for polychlorinated

biphenyls (PCBs). For the most part, liquid PCBs at concentrations in excess of 50 ppm must be disposed in an incinerator that meets the following 40 CFR 761.70 requirements:

- A 2-second dwell time at 1200°C and 3 percent excess oxygen in the stack gas or a 1.5 second dwell time at 1600°C and 2 percent oxygen in the stack gas.

- A combustion efficiency of at least 99.9 percent.

- Stack emissions must be monitored for O_2, CO, CO_2, NO_x, HCl, total chlorinated organic content (RCl), PCBs, and total particulate matter.

- Wet scrubbers should be used for control of HCl emissions.

In addition to the criteria listed above for liquid PCBs, the incineration of nonliquid PCBs must have mass air emissions less than 0.001 g/kg of the PCB introduced.

Liquids, including mineral-oil dielectric fluid with PCB concentrations between 50 and 500 parts per million (ppm) must be disposed in one of the following ways:

- Incinerator that meets 40 CFR 761.70 requirements
- Chemical waste landfill that meets 40 CFR 761.75 requirements
- High efficiency boiler

Nonliquid PCBs (including contaminated soil, dredge spoil, and sewage treatment sludges) at concentrations greater than 50 ppm must either be incinerated or disposed in a chemical waste landfill. Nonliquid PCB's at concentrations greater than 500 ppm must be incinerated.

The chemical waste landfills used for the disposal of PCB must meet the following specifications:

- A compact soil liner 3 feet thick (or 4-foot-thick layer of in-situ soil) with a permeability less than or equal to 1×10^{-7} cm/sec, more than 30 percent passing a No. 200 sieve, liquid limit greater than 30, and a plasticity index greater than 15.

- A synthetic liner can be used if it is at least 30 mils thick.

- The bottom of the landfill must be above the historical high water-table. No hydraulic connection between the site and the standing or flowing surface water is permitted.

- If the landfill is above the 100-year floodwater elevation, all surface water runoff from a 24-hour, 25-year storm must be diverted. If it is in the 100-year floodplain, surface water diversion dikes must be built.

- Groundwater must be monitored for PCBs, pH, specific conductance, and chlorinated organics.

- A leachate collection system must be installed.

- Bulk liquids with concentrations of 50 to 500 ppm may be disposed if the waste is pretreated and/or stabilized to reduce its liquid content. Containers of PCBs may be disposed of if each container is surrounded by an inert sorbent material capable of absorbing all the liquid contents.

- The site must be surrounded by a 6-foot woven mesh fence.

Dioxin Requirements (40 CFR 775)

This section was written specifically for the removal and disposal of dioxin-contaminated wastes at the Vertac Chemical Company in Memphis. However, it contains some general requirements for dioxin wastes:

- EPA must be notified 60 days in advance of the intended disposal.

- The concentration, total quantity, and the number of containers involved must be reported.

- The proposed disposal method, location, and the name of the disposal firm(s) must be included.

- The present status of the waste must be indicated, including the method of containment, and the presence or absence of a containment pad or dike, a roof, or access restrictions.

- EPA Interim Advisories for PCB Removal Action-Levels in Soil and Drinking Water

  - Acute and chronic advisory levels for PCBs are presented. Chronic levels will be applicable for remedial actions.

  - These advisories are developed based on two risk pathways: soil ingestion by children and inhalation of volatilized PCBs.

  - Ingestion of bioaccummulated fish is not considered; where it is a controlling factor (risk), these advisories should be reevaluated.

- Advisories are given for four classes of sites:

  -- 0.2 ppm - Readily accessible to children (risk of soil ingestion).*

  -- 0.2 ppm - Not accessible to children, but in a populated area; contaminated soil has minimum of 10 cm cover material.

  -- 20 ppm - No affected population within 0.1 km of site; contaminated soil has minimum of 10 cm cover material.

  -- 40 ppm - No affected population within 1.0 km of site; contaminated soil has minimum of 10 cm cover material.

- Health Advisories

Suggested No Adverse Response Levels (SNARLs) are developed for water suppliers by the Office of Drinking Water. The SNARLs provide guidance for 54 chemicals that may be encountered intermittently in drinking water and are believed to cause a near-term risk, but which are not regulated by other standards. SNARLs are not mandatory requirements. They are calculated to reflect a daily consumption of 1 liter of water by a 10-kg child for three exposure levels--1 day, 10-days, and long-term (weeks or months). SNARLs do not consider carcinogenic risks or the synergistic effects of chemicals.

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*Chronic advisories are shown here.

- New Jersey Hazardous Waste Management Regulations

Subchapter 10 of the New Jersey Administrative Code (NJAC 7:26) presents operational and design standards for hazardous waste facilities. It is divided into a number of sections that roughly correspond to those in RCRA.

- New Jersey Water Pollution Control Laws

NJSA 58:10 prohibits the discharge of hazardous substances. In the event of such a discharge, prompt containment and removal is required. The act also provides a Spill Compensation Fund for compensation to resort businesses and other people damaged by a discharge. The fund consists of per-barrel taxes levied on owners or operators of major facilities (refineries, storage facilities, pipelines, drilling platforms, or deep-water ports) for petroleum and petroleum products.

This act (NJSA 58:10A) also empowers the State with administration of the state's water pollution control program, in particular, the New Jersey Pollutant Discharge Elimination System (NJPDES).

- New Jersey Water Quality Planning Act

The objective of this act (NJSA 58:11) is to restore and maintain the chemical, physical, and biological integrity of the state's waters, including groundwaters. It also promotes the area-wide waste treatment management plans to assure control of sources of water pollutants.

- New Jersey Hazardous Discharges Law

This act (NJSA 13:1 K) provides for reporting requirements and penalties for releases of hazardous substances.

- New Jersey Water Pollution Control Regulations

  These regulations (NJAC 7:1E) cover every discharge of petroleum and other hazardous substances except those in compliance with a valid state or Federal permit. They present guidelines to be followed in the event of a spill, as well as reporting, design, and maintenance requirements for facilities that handle hazardous substances.

  Any discharge of a substance in a quantity or concentration that may be harmful or that poses a foreseeable risk must be reported to the Department of Environmental Protection. Facility owners or operators must take containment measures. Facilities must file a Discharge Prevention Containment or Countermeasure (DPCC) Plan and a Discharge Cleanup and Removal (DCR) Plan with the state.

  In most cases, facilities will be required to have observation wells at a density of either one per acre or one per source, whichever is less. These wells shall be sampled and analyzed quarterly for parameters that are acceptable to the state. Background levels must also be determined.

- New Jersey Pretreatment Regulations

  These regulations (NJAC 7:9-5) provide for protection and enhancement of surface waters, disinfection, and minimum treatment requirements for wastewater facilities pursuant to NJSA 58:10A and NJSA 58:11A.

- New Jersey Pollutant Discharge Elimination System (NJPDES) Regulations

  It is the intent of the NJPDES (NJAC 7:14A) program to regulate

  - Discharge of pollutants to surface waters and groundwaters
  - Industrial discharges to municipal or privately-owned treatment works

- Land application of residuals and wastewaters (subchapter 4)
- Discharge of leachate to surface waters or groundwaters (subchapters 3 and 4)
- Discharge of pollutants into wells
- Treatment/storage/disposal of hazardous waste (those not regulated by NJAC 7:26)

Land Application

The maximum depth of the treatment zone may not exceed 1.5 meters from the ground surface or be less than 1 meter above the seasonal high water-table. Run-on and runoff from a 24-hour, 25-year storm must be controlled.

When wastes are applied to crops, requirements must be met for cadmium and other hazardous constituents (NJAC 7:14A-4.7(i)). The unsaturated zone must be monitored for specified contaminants.

Discharges to Groundwater

Regulated under NJAC 7:14A-6 are permitted hazardous waste facilities such as surface impoundments or landfills, land application facilities, and infiltration lagoons. The following groundwater parameters must be analyzed:

1. Arsenic, barium, cadmium, chromium, fluorine, lead, mercury, nitrate, ammonia, selenium, silver, iron, manganese, sodium, sulfate, and chloride.
2. Phenols.
3. Lindane; methoxychlor; toxaphene; 2,4-D; 2,4,5-TP Silvex; and endrin.
4. Radium, gross alpha, and gross beta.
5. Turbidity and coliform bacteria.

6. pH, TOC, TOX, and TDS.
7. Other organics as required.

Initial background levels must be established, or all parameters must be measured monthly for 1 year. At least four replicate samples must be collected monthly for items (6) and (7) above. After the first year, (1) through (5) must be analyzed monthly; (6) and (7) must be measured at least monthly; and static water elevation must be determined. Significant increases in contamination above MCLs must be reported immediately.

- New Jersey Surface Water Quality Standards

These standards (NJAC 7:9-4) are used to regulate the introduction of toxic substances into surface waters.

- New Jersey Hazardous Waste Facilities Siting Act

This act (NJSA 13:1E) authorizes NJDEP to provide for the siting, design, construction, operation, and use of environmentally-acceptable major hazardous waste facilities.

- New Jersey Safe Drinking Water Act (N.J.S.A. 58:12A-1)

NJSA 58:12 is a general act that sets standards for public water supply systems particularly regarding supply, distribution, and storage. The Act also requires the state to develop MCLs, which are expected in late 1986. An initial and periodic testing schedule was specified in NJAC 7:10-14, along with recommended interim safe contaminant levels for drinking water. Sixteen contaminants are presently included, and the state expects to add six more when test methodologies are developed. These testing rules are commonly referred to as "A-280".

2.2 Response Actions and Remedial Technologies

The general response actions and remedial technologies that meet the remedial action objectives outlined in Section 1.0 are listed in Table 2-1. Tables 2-2 and 2-3 are preliminary screening summaries that show the broader range of technologies which were considered and a brief note as to why some were screened from further consideration.

The remaining technologies from Table 2-2 and Table 2-3 were screened in accordance with the previously identified technical, public health, environmental, institutional, and cost criteria. In the following subsections, each technology is reviewed and each criteria addressed, where necessary. If the technology is rejected for use at the site for an individual criteria, the technology is eliminated from further consideration. Discussion of other screening criteria for the technology is not continued.

2.2.1 No Action/Monitoring

The no-action alternative does not address the remediation of the site nor the potential threat to the environment or the public via the associated contamination pathways. Though onsite contamination will not be mitigated, it will be carried through the full evaluation process in each remedial component as a remedial action alternative, for comparison purposes, as required in the FS Guidance Document.

2.2.2 Surface Capping

Capping techniques are designed to minimize groundwater contamination caused by infiltration through contaminated soils and to reduce offsite transport of contaminants. Capping is normally performed in conjunction with other site-closure activities.

TABLE 2-1

GENERAL RESPONSE ACTIONS AND REMEDIAL TECHNOLOGIES
CALDWELL TRUCKING COMPANY SITE

General Response Action	Associated Remedial Technologies
No Action	Monitoring
Containment	Capping
Diversion and Collection	Ditches, berms, sedimentation basins, regrading, and revegetation
Restrict Access	Fencing of areas with contaminated surface soils.
Partial Removal	Excavation of wastes, contaminated soils, and tanks
Complete Removal	Excavation of wastes, contaminated soils, and tanks
Disposal	Landfill
Alternative Water Supply	Treatment of Well No. 7, municipal supply in plume area
Treatment of Contaminated Soils	Post excavation • Incineration - Rotary kiln - Fluidized bed - Multiple hearth • Solidification - Lime based - Cement based - Thermoplastic - Glassification
Treatment of Liquid Wastes	Powdered Activated Carbon Treatment (PACT) Activated carbon Air stripping Ion exchange Filtration Biological

TABLE 2-2

TECHNOLOGY SCREENING SUMMARY
SCREENING CRITERIA AND ASSESSMENT
CALDWELL TRUCKING COMPANY SITE

Remedial Technology	Implementability	Compatibility with Site Conditions	Technical Status	Remarks
1. Capping	Acceptable	Acceptable	Acceptable	Effectively isolates contaminated media.
2. Regrading	Acceptable	Acceptable	Acceptable	Necessary in controlling runoff and in proper installation of cap.
3. Revegetation	Acceptable	Acceptable	Acceptable	Necessary in controlling runoff and in proper installation of cap.
4. Diversion and Collection	Acceptable	Acceptable	Acceptable	May be necessary during remedial action to control runoff.
5. Groundwater Barriers	Acceptable	Unacceptable	Acceptable	Fractured bedrock and boulders in glacial material would complicate installation and limit effectiveness.
6. Groundwater Pumping	Acceptable	Unacceptable	Acceptable	Excessive time period needed to achieve desired level of cleanup.
7. Subsurface Collection Drains	Unacceptable	Unacceptable	Acceptable	Not applicable to site conditions.
8. Gas Collection	Acceptable	Unacceptable	Acceptable	Not applicable to site problems.
9. Excavation	Acceptable	Acceptable	Acceptable	--

TABLE 2-2
TECHNOLOGY SCREENING SUMMARY
SCREENING CRITERIA AND ASSESSMENT
CALDWELL TRUCKING COMPANY
PAGE TWO

Remedial Technology	Implementability	Compatibility with Site Conditions	Technical Status	Remarks
10. Sediment Removal	Acceptable	Unacceptable	Acceptable	Not applicable to site problems.
11. Sediment Controls	Unacceptable	Unacceptable	Acceptable	Not applicable to site problems.
12. Landfill	Acceptable	Acceptable	Acceptable	--
13. Surface Impoundments	Unacceptable	Unacceptable	Acceptable	Not applicable to site problems.
14. Land Application	Unacceptable	Unacceptable	Acceptable	Not applicable to site problems.
15. Waste Piles	Unacceptable	Unacceptable	Acceptable	Not applicable to site problems.
16. Deep Well Injection	Unacceptable	Unacceptable	Acceptable	Not applicable to site problems.
17. Fencing	Acceptable	Acceptable	Acceptable	--
18. Treatment of Contaminated Soils and Wastes	Acceptable	Acceptable	Acceptable	May be applicable to site conditions (see Table 2-3).
19. No Action	--	--	--	--
20. Alternative Water Supply	Acceptable	Accceptable	Acceptable	--

TABLE 2-3

PRELIMINARY TECHNICAL SCREENING SUMMARY OF TREATMENT TECHNOLOGIES
CALDWELL TRUCKING COMPANY SITE

Technology	State of Development	General Treatment Category	Chlorinated Aliphatics	Polynuclear Aromatics	PCBs and Dioxin	Lead and Other Metals	Pass Initial Screening (Yes or No)
Soils/Solids							
• **Insitu**							
Soil Flushing	D	O/I	+	+	P	+/P	Y
In-situ Vitrification	D	I	P	P	ID	+	N
<u>Biotreatment</u>							
– Bioreclamation	E	O	–	+/P	–	–	Y
– Specialized Microorg.	D/E	O	IN	+	+	–	Y
Oxidation	D/A	O/I	+/P	+	IN	P	N
Chemical Dechlorination	D	O	+	–	+	–	N
Sorption	A	O/I	+	+	+	P	N
Reduction	D	O/I	P	P	–	+	N
Photolysis	D	O	–	P	+/P	–	N
• **Post Excavation**							
<u>Incineration</u>							
– Rotary Kiln	C	O	+	+	+	–	Y
– Low-Temp. Kiln	A	O	P	P	P	–	Y
– Fluidized Bed	E	O	+	+	+	–	Y
– Multiple Hearth	E	O	+	+	P	–	Y
<u>Solidification</u>							
– Lime Based	E	I	–	–	–	+	Y
– Cement Based	C	I	–	–	P	+	Y
– Thermoplastic	D	I	–	–	P	+	Y
– Pozzolanic	D	I	–	–	IN	+	N
– Glassification	D	I	–	–	IN	+	Y

TABLE 2-3
TECHNICAL SCREENING SUMMARY OF TREATMENT TECHNOLOGIES
CALDWELL TRUCKING COMPANY SITE
PAGE TWO

Technology	State of Development	General Treatment Category	Chlorinated Aliphatics	Polynuclear Aromatics	PCBs and Dioxin	Lead and Other Metals	Pass Initial Screening (Yes or No)
Soils/Solids (Continued)							
• **Post Excavation (Continued)**							
Chemical							
– Extraction and Treat.	D	O/I	+	+	+/P	+/P	Y
Aqueous and Liquid Streams							
PACT	C	O	+	+	+/P	P	Y
Activated Carbon	C	O	+	+	+	P	Y
Air Stripping	C	O	+	P	–	–	Y
Ion Exchange	E	O/I	–	P	P	+	Y
Filtration	C	I	–	–	–/+	–	Y
Bio Treatment (POTW)	C	O	P/–	P	P/–	–	Y

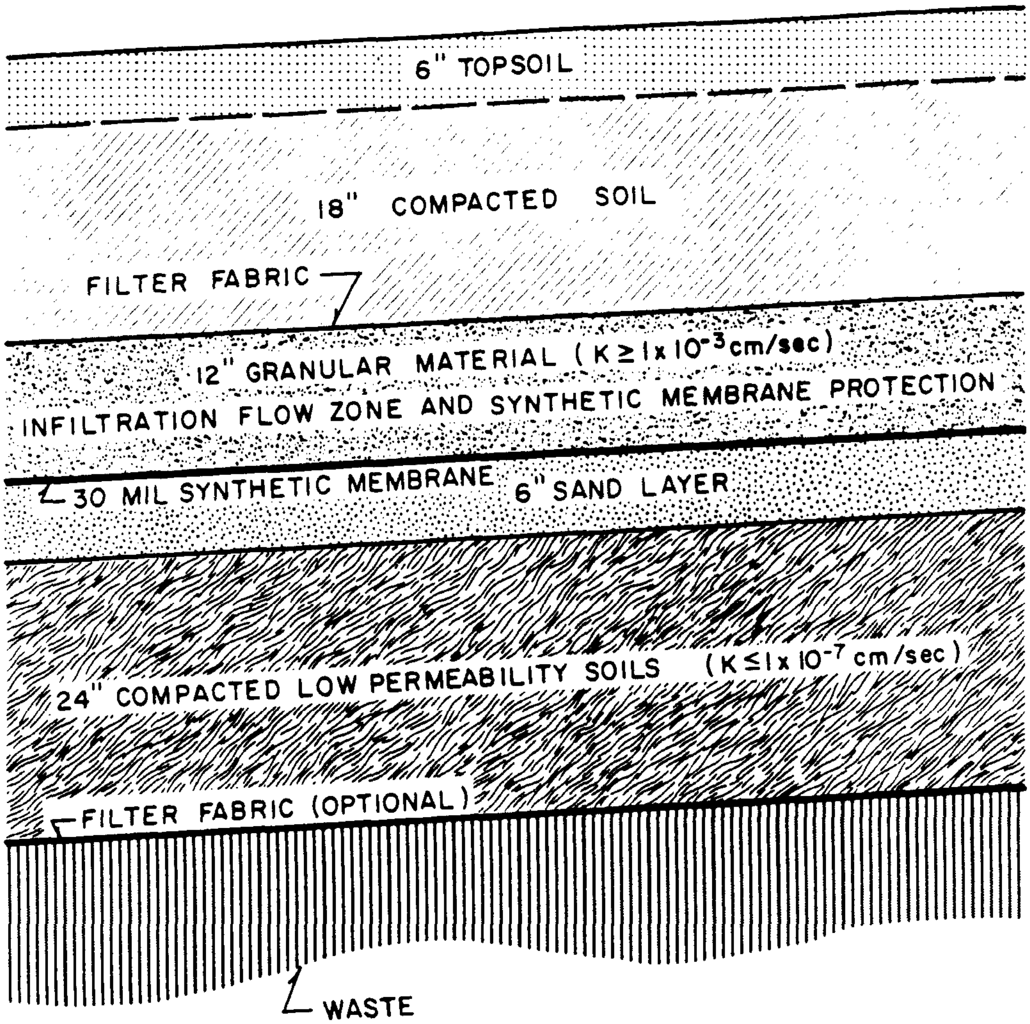
O – Organics
I – Inorganics
C – Commercial (State of the Art)
E – Established
D – Developmental
A – Alternative Technology
\+ – Effective
P – Possible Technology
– – Not Applicable
IN – Insufficient Data

Possible capping materials include the following:

- Sprayed bituminous membrane
- Chemical sealants/soil additives
- Asphalt
- Synthetic membranes
- Soil
- Clay
- Multimedia cap (synthetic membrane and clay)

Clay (low-permeability soils) and synthetic membranes have been used in numerous hazardous waste capping and liner applications and are also specified by the EPA in the Part 265 regulations under the Resource Conservation and Recovery Act (RCRA) and by the NJDEP in the hazardous waste regulations. Therefore, other capping materials will not be considered further. However, disadvantages may exist with respect to extended exposure/deterioration of some synthetic materials.

According to RCRA and NJDEP requirements, final cover for a landfill must be designed and constructed to provide long-term minimization of liquids through the closed landfill, function with minimum maintenance, promote drainage and minimize erosion of the cover, accommodate settling and subsidence to maintain the cover's integrity, and have a permeability less than or equal to the permeability of any bottom liner system or natural subsoils. A cap conforming to these requirements for the Caldwell Trucking Company Site would be a multimedia cap consisting of a 30 mil (minimum) synthetic membrane above 24 inches of soil with a permeability of 10^{-7} cm/sec, as the liner material. A 12-inch flow zone of at least 10^{-3} cm/sec permeability, covered by filter fabric, 18-inches of compacted soil, and 6-inches of top soil are required above the liner material. A typical multimedia cap is shown in Figure 2-1. Application of such cap at the Caldwell Trucking Company Site would also require an upgradient surface runoff diversion and a diversion wall down to bedrock to minimize flow under the cap from the upslope area. The extent of the cap and location of the diversion wall are shown in Figure 2-2.



CTC 001 1163

REFERENCE: NJAC 7:26.10.8(i)

FIGURE 2-1

TYPICAL MULTIMEDIA CAP

CALDWELL TRUCKING CO. SITE, FAIRFIELD TWP., NJ

NOT TO SCALE

NUS CORPORATION
A Halliburton Company

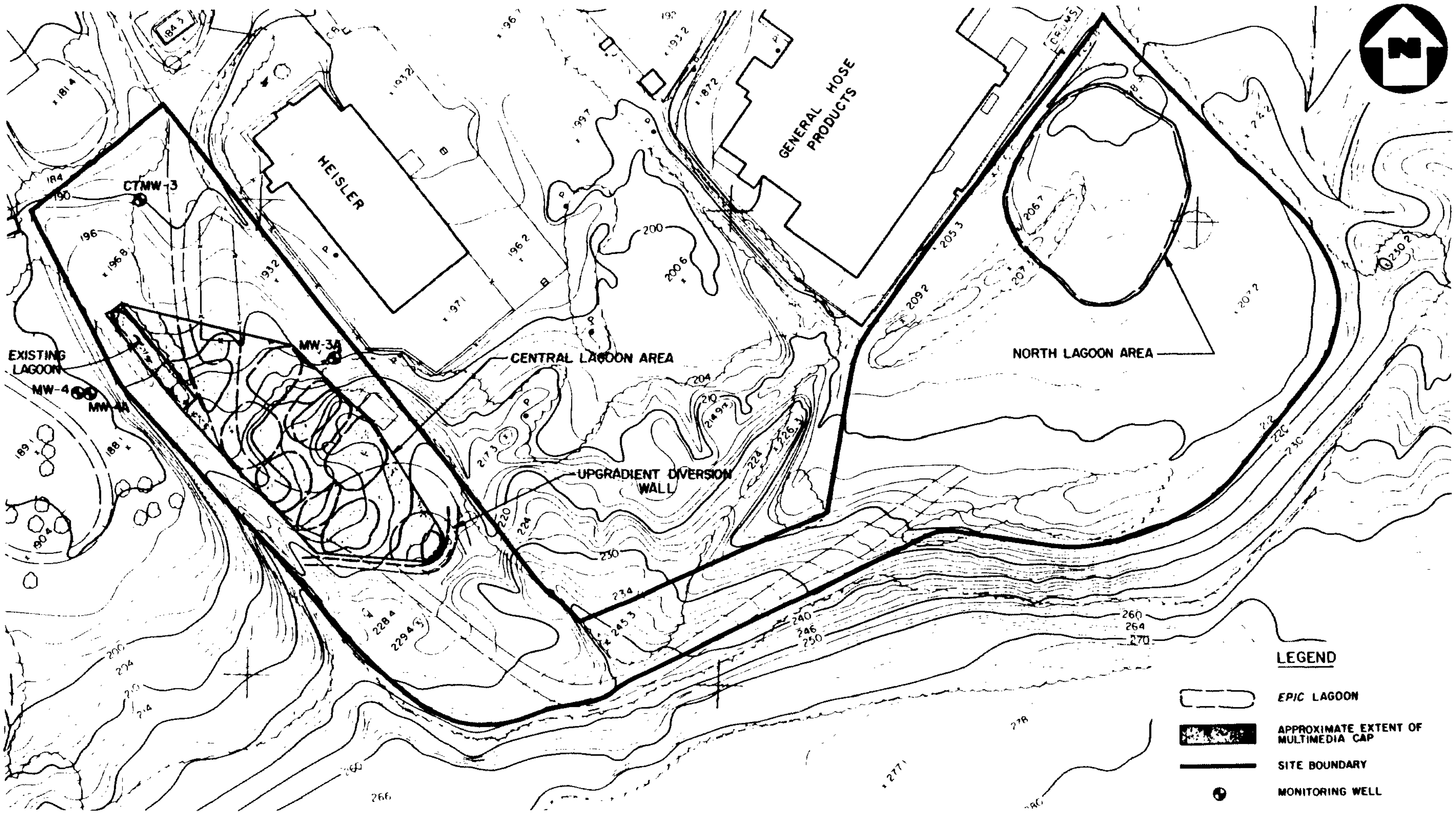


FIGURE 2-2

APPROXIMATE EXTENT OF MULTIMEDIA CAP
CALDWELL TRUCKING CO. SITE, FAIRFIELD TWP., NJ

0 100 200
SCALE IN FEET

NUS CORPORATION
A Halliburton Company

CTC 001 1164

Single-layer synthetic, clay, or soil caps are unacceptable caps for minimizing infiltration and leachate generation, based on NJDEP design specifications. However, each would be effective in minimizing contact with and migration of contaminated surface soils. Of these the soil cap is the best, based on material cost and availability on and ease of installation. EPA interim advisories on PCB contamination in surface soils recommend a minimum 10 cm soil cover on soils with PCB levels greater than or equal to 0.2 ppm. Soil cover can be provided at the same time and as an extension of the final cover for the multimedia cap, or at the same time and as an extension of backfilling excavated areas with clean material. Therefore a soil cap of at least 10 cm (4 inches) will be retained for further consideration in remediating contact with PCB-contaminated soils. The areas considered for soil and multimedia capping are the same as those shown in Figure 1-6. The areas with contaminated surface soils only would have the soil cap, whereas the area with contaminated subsurface soils would require the multimedia cap (as shown in Figure 2-2). Installation of a multimedia cap for site closure will require installation of a groundwater monitoring system, according to Federal and state regulations. Existing monitoring wells may be suitable for monitoring the area around the multimedia cap.

2.2.3 Surface Grading and Revegetation

Grading and revegetation are widely accepted engineering practices and are applicable for this site.

2.2.4 Surface Water Diversion and Collection

Berms, diversion ditches, and sedimentation basins are standard engineering methods to control run-on and runoff of surface water and sediment. Lined sedimentation basins may be necessary to collect fluids drained from soils excavated below the water table. Such basins would allow evaporation of the water, prevent infiltration of the water, and retain the solid residuals to be handled with the rest of the contaminated soils on the site.

2.2.5 Contaminated Soil Excavation

This technology involves the physical removal of the wastes and contaminated soils using common excavation practices. Typical equipment includes draglines, backhoes, clamshells, and dozers. Excavated material may include both surface and subsurface soils.

Excavation is a commonly used and well-established technique that involves standard engineering technology.

2.2.6 Fencing of Areas with Contaminated Surface Soils

Fencing is an established technique with wide application. However the long-term reliability in restricting access to contaminated surface soils on the site is questionable, particularly in comparison to the more reliable removal or capping techniques. Therefore, fencing for the purpose of minimizing contact with contaminated soils will not be considered further. However, full site fencing will very likely be a part of any large-scale remedial measure implemented on the site to minimize trespassing.

2.2.7 Landfill Disposal

Landfill disposal is applicable for tank wastes, contaminated soils, and tank demolition wastes. Landfill disposal can be implemented on site in a newly constructed landfill or off site in an approved landfill in accordance with RCRA, Toxic Substances Control Act (TSCA), and EPA requirements for selecting an offsite option in a Superfund response action.

Onsite disposal necessitates the construction of a secure hazardous waste landfill. Elements of such a site should meet the applicable RCRA, TSCA, and NJDEP technical requirements. Thus, the landfill design would include a lined impoundment, a leachate and runoff collection system, and a final cover to reduce precipitation infiltration. The liner consists of the following:

- 1 foot leachate collection system
- 30 mil synthetic
- 1 foot leachate detection system
- 30 mil synthetic liner
- 2 foot clay (10^{-7} cm/sec permeability)

The cap design would be identical to the multimedia cap design previously described.

The location, layout, and preliminary design of the onsite landfill are shown in Figures 3-3 and 3-5 and discussed in Section 3.0. The facility meets all applicable regulations except several RCRA and NJDEP siting requirements. In fact, this facility and the Central Lagoon Area excavation may encroach upon the neighboring properties to the east and south of the site. If an alternative that includes excavation and landfilling is chosen, these issues must be addressed in the detailed design of the alternative.

2.2.8 Tank Removal

This technology involves physically removing the tanks from the site. Salvage materials may be cleaned and decontaminated, as required, prior to being removed from the site. Materials that cannot be salvaged or decontaminated will be loaded into trucks and hauled to an approved landfill (or the onsite landfill). After removal, excavated areas will be backfilled with noncontaminated material and regraded.

The tanks on the Caldwell Trucking Company Site may not need to be disposed off site. It may be possible to simply flush or steam clean them and leave them in place. The precise disposition of the tanks will be at the descretion of EPA and can be decided during the design phase. However, for costing purposes here, it is assumed that the tanks will be excavated and disposed offsite in an EPA approved landfill.

2.2.9 Alternative Water Supply

Drinking water treatment for Municipal Well No. 7 will be evaluated as a feasible alternative to bring the well back into service. The design and cost of the treatment system have been developed by the Township of Fairfield prior to this RI/FS and will be used as the basis for the evaluation herein. Returning Municipal Well No. 7 to service will restore the use of a major resource to the town while the suspected additional sources of contamination of the well are investigated further.

Purchase of water from Passaic Valley Water Commission will also be considered as a solution for the contamination of Municipal Well No. 7.

Municipal water system tap-in will be considered for the alternative water supply in the downgradient plume area. Providing municipal water to all residences in this area will minimize exposure to contaminated groundwater through domestic uses.

The three options of alternative water supply, drinking water treatment, municipal system tap-in and purchase from Passaic Valley Water Commission will be retained for further consideration and evaluation for Remedial Components 1 and 2.

2.2.10 In-Situ Control Technologies

Soil Flushing

Contaminant extraction can be accomplished using a method that is commonly referred to as soil or solvent flushing. This process is applicable to the treatment of organic or inorganic wastes. Water and a surfactant have been successfully used in the laboratory to remove organic wastes. A weak acidic or basic solution has been used to extract inorganic contaminants.

In the extraction process the required solution is applied to the soil and allowed to percolate into the unsaturated zone where contaminant mobilities are altered. The solution is then permitted to migrate into the shallow groundwater. This groundwater is extracted with the aid of shallow groundwater wells, or French drains. The elutriate must then be treated on site, disposed off site, or reinjected.

The use of this technology on site would involve a multiphase process, inorganic contaminant flushing, and organic contaminant flushing. Waste treatment would involve the flooding of the contaminated areas to permit total flooding of the unsaturated soil zone. A collection well field would be installed downgradient of the site to recover the groundwater and leached contaminants.

Engineering the collection system in conformity with site conditions seems to present significant problems. The presence of large boulders in the glacial till above the bedrock makes the construction of a vertical groundwater barrier, a necessary part of the system, technically infeasible. Also, the fact that the bedrock beneath the site is highly fractured makes containment of the flushing solution highly improbable. This problem can be remedied; however, the effort would be long and expensive, and there would be no guarantee of the success of the operation. Because of the engineering difficulties associated with the implementation of this process at the site, it was not retained for inclusion in an alternative.

Biodegradation

Biodegradation refers to the destruction of chemical wastes by biological metabolism. Bioreclamation, the use of natural aerobic organisms to achieve contaminant destruction, is an option that is commercially available for use. The use of specifically cultured organisms is also a viable option. Bioreclamation has been shown to effectively degrade a large variety of organic contaminants. It has not, however, been found to be effective in the treatment of chlorinated aliphatics or PCBs. On the other hand, some microorganisms have been developed that can degrade PCBs and chlorinated hydrocarbons.

Because of the presence of PCBs and other chlorinated organics on the site, the use of natural organisms to treat the contaminants is highly unlikely. However, specifically designed organisms can be introduced into the system that can degrade chlorinated organics, including PCBs. This process will not, however, address metals in the soils. Also, the metals may very likely be inhibitory to the degradation process.

Implementation on the site of in-situ biodegradation would be very difficult for the following reasons:

- Metal contamination in the soil matrix may inhibit the biological action to the extent that the process will not be effective.

- The treatment efficiency, apart from the metals inhibition, may not be adequate to achieve the desired level of cleanup.

- The completion of the process will be very difficult to validate with any degree of confidence.

- Application of the process requires control of subsurface conditions such as nutrient availability, pH, and oxygen supply which would be very difficult to ensure in such heterogeneous soils as those present on the site.

- Since much of the soils to be treated are in the unsaturated zone, the flushing action needed to provide contact with and nourishment of the organisms will cause increased leaching of the mobile contaminants and will contribute to groundwater contamination beneath the site.

- The irregular soil characteristics at the site will limit the effectiveness of the process by causing nonuniform flow through the unsaturated zone. This will prevent contact of all waste and contaminated soils with the microbial suspension.

- The biodegradation process may yield more mobile and/or toxic by-products which would be released to the groundwater beneath the site.

Biodegredation will not be considered further in this study based on difficulties and uncertainties related to its implementability at this site, some of which could not be addressed even with additional study.

2.2.11 Post-Excavation Treatment Technologies

Post-excavation technologies include those processes that require the soil to be excavated and loaded into a treatment system. The established technologies generally include two categories, incineration and solidification. However, extraction and treatment is a new technology that passed the preliminary screening and will be reviewed herein. Because incineration is used to treat organic contaminants and solidification to treat material contaminated with inorganics, a combination of these treatment groups may be required to achieve adequate soil/solids remediation at the site. Some consideration was therefore given to retaining a technology for further consideration when recognized only as a partial solution.

The following sections provide a description of the direct treatment technologies and the criteria by which they were screened.

Incineration

Organic contaminants in the soil matrix can be efficiently destroyed by incineration at high temperatures. Typically, contaminant destruction occurs within an incinerator at temperatures in excess of 2000°F. The incineration process can be completed on site by the use of a mobile treatment system or can be transported off site to a commercial facility. The incineration processes that are appropriate for soil decontamination include

- Rotary kiln
- Multiple hearth
- Fluidized bed

Generally, all of these processes are high-temperature units in which complete destruction of organic materials is achieved. However, a low-temperature unit may be used to dry the soil, drive off the volatile organics, and provide some measure of sterilization relatively inexpensively. Neither incineration nor drying would be effective in reducing the metals concentrations in the soils. Thus, a companion technology may be necessary if onsite incineration or drying is chosen. These would include landfilling as described previously and solidification as described below.

The rotary kiln is currently the most widely used process; however, this does not preclude the use of the other systems. The permitted commercial incineration systems are all rotary kilns.

Solidification

- Cement-Based Systems

  Portland cement is the primary ingredient used to solidify wastes by this process. A cement/fly-ash mixture has been used commercially to solidify primarily inorganic wastes. Wide application of this process has been for the treatment of incinerator wastes. Some problems will be encountered in direct treatment of the lagoon sludges in that degradation of the organic material may later allow for the leaching of some of the solidified contaminants.

- Lime-Based Systems

  This technology is similar to the cementation process; however, lime is used as the principal ingredient. Similar wastes can be treated at lower cost; however, solidification using the lime system is not expected to last as long as cement-based systems.

- Thermoplastic Systems

  Asphalt in its molten form is blended with the contaminated soil matrix to form a solidified mass with low leaching characteristics. The asphalt base (also used are bitumen, polypropylene, and polyethylene) is first heated to between 260° and 450°F, then mixed with the soil and, upon cooling, forms the solidification matrix. This mixture has been found to be resistant to leaching and to biological degradation. This quality makes it suitable for soils contaminated by organic wastes. The presence of significant amounts of solvents to the soil may preclude the use of this technology because many solvents have a detrimental effect upon the resultant matrix.

- Glassification

  In general this process involves heating the material to very high temperatures (2500°F) at which the soil matrix will fuse into a glass - or ceramic-like mass. This process has very low potential for contaminant release via leaching; however, it cannot be used for soils contaminated by organics. The high temperatures used will drive off the organic contaminants. Glassification may be ideal for treating soil that has been pretreated by incineration, whereby the soil temperature is already elevated, and will require little additional heat to fuse the soil.

If direct application of solidification technologies is desired (without first incinerating), the cement-based process appears to have the best applicability, since it has been the best tested and most widely used process. Thermoplastic systems are also a valid option if a small amount of organics are present. For soil that is to be first incinerated, the glassification option shows significant promise.

Solidification was retained for further evaluation in combination with technologies that will complement its weaknesses. Thus, lime-based or cement-based solidification will probably be adequate from the technical aspects. They would also be easily implemented and inexpensive relative to thermoplastic and glassification systems.

Extraction

The extraction process is very similar to the in-situ soil flushing technology described previously. It differs in that the extraction of the contaminants is performed following excavation of the soils and sludges. This technology has an advantage over the in-situ process in that much greater control can be achieved over such a system. The extent of treatment can also be more readily established.

In the post-excavation extraction process, the soils are excavated and loaded into an onsite treatment system. In the system, the required solution is applied to the soil and allowed to percolate through. Contaminant mobilities are altered by the action of the solvent. The elutriate is then collected and must be treated on site or disposed off site.

The use of this technology on site would involve a multiphase process, inorganic contaminant flushing, and organic contaminant flushing.

This is still a developmental technology, with very limited information available on its application under various soil conditions and contaminants. Thus evaluations of any operational considerations cannot be made. The results of the process would also be very difficult to predict in relation to the soil action levels (treatment efficiency). Finally, there is little information available for design and cost evaluations. It is therefore screened from further consideration.

2.2.12 Waste Treatment

Liquid Wastes

The disposal of the contaminated liquids and sediments found in the onsite tanks is expected to be one of the first actions taken at the site. Rapid disposition of these wastes will be a key concern to the initiation of a remedial action. Because the volume of material is relatively small (19,500 gallons), expeditious treatment may best be accomplished off site. Treatment at a facility that offers PACT technology will permit a total waste stream remediation (inorganics and organics). Since total waste compatability cannot be assured, a sample of the waste should be sent to the PACT facility before bulk shipment.

Treatment of contaminated waste streams generated by an onsite soil treatment system may be applicable to remediation of this site. Logistical considerations indicate that treatment of the waste streams on site will be a prudent solution. Since a potentially large volume of water will not have to be shipped off site and since the water can be treated as it is produced, the chance for a contaminant release will be reduced.

Incineration and solidification are the only onsite treatment processes for the Caldwell Trucking Company Site that meet all the screening criteria. Incineration is expected to generate some wastes. It is not anticipated that solidification will generate waste by-products.

One requirement of the incineration process is the cleanup of the off gases. One of the required treatment methods is the use of a wet scrubber for acid gas removal. This waste stream could be relatively small if a recycle loop is included; however, some treatment will be required. The necessary treatment steps will include pH adjustment and metals removal. Organics destruction will be completed in the incinerator. The units applicable to these processes include filtration, physical/chemical treatment, and ion exchange units.

<u>Solid/Sludge Wastes</u>

The solid wastes remaining in the existing lagoon may best be treated by the same processes that are applicable to the soils treatment. The volume of this material is small and the level of contaminant concentrations are similar to the soils. Thus this material could be mixed with the onsite soils and treated or disposed in the same manner.

2.3 Development and Screening of Remedial Action Alternatives

The technologies that passed the screening process are summarized in Table 2-4 and Table 2-5. They were assembled into remedial alternatives that address all of the remedial objectives for the Caldwell Trucking Company Site. Partial solutions were not considered except as indicated in each alternative. As required in the EPA FS Guidance under CERCLA (EPA, June 1985), at least one alternative for each operable unit should be considered for each of the five remedial alternative categories:

- Alternatives for treatment or disposal at an offsite facility approved by EPA (including RCRA, TSCA, Clean Water Act (CWA), Clean Air Act (CAA), and Safe Drinking Water Act (SDWA) approved facilities), as appropriate.

- Alternatives that attain applicable and relevant Federal public health or environmental standards.

- As appropriate, alternatives that exceed applicable and relevant public health or environmental standards.

- Alternatives that do not attain applicable or relevant public health or environmental standards but that will reduce the likelihood of present or future threat from the hazardous substances. This category must include an alternative that closely approaches the level of protection provided by the applicable or relevant standards and meets CERCLA's objective of adequately protecting public health, welfare, and the environment.

- A no-action alternative.

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TABLE 2-4

SUMMARY OF TREATMENT TECHNOLOGIES AND CONTAMINANT CATEGORIES
CALDWELL TRUCKING COMPANY SITE

	Volatiles in Subsurface Soils	PAHs in Surface Soils	PAHs in Subsurface	PCBs in Surface	PCBs in Subsurface	Metals in Subsurface
Post-Excavation						
Incineration (high temperature)	✓	✓	✓	✓	✓	X
Solidification	X	X	X	✓	✓	✓
Incineration and Solidification	✓	✓	✓	✓	✓	✓
Incineration (low temperature)	✓	X	X	X	X	X

✓ Will Address
X Will Not Address

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TABLE 2-5

SUMMARY OF REMEDIAL TECHNOLOGIES AND EXPOSURE PATHWAYS/MIGRATION ROUTES CALDWELL TRUCKING COMPANY SITE

PATHWAYS OF EXPOSURE/ROUTES OF MIGRATION

Surface Water Runoff From North Lagoon Area	Onsite Surface Soils and Wastes	Leachate From Contaminated Soils and Wastes In Central Lagoon Area
1. No action	1. No action	1. No action
2. Capping (soil cover)	2. Capping (soil cover)	2. Capping (multimedia)
3. Excavation (surface soils)	3. Excavation (surface soils)	3. Excavation (subsurface soils)
4. Onsite disposal (landfill)	4. Onsite disposal (landfill)	4. Onsite disposal (landfill)
5. Offsite disposal (landfill)	5. Offsite disposal (landfill)	5. Offsite disposal (landfill)
6. Onsite incineration/ solidification	6. Onsite incineration/ solidification	6. Onsite incineration/ solidification
7. Onsite incineration/ onsite landfilling	7. Onsite incineration/ onsite landfilling	7. Onsite incineration/ onsite landfilling
8. Offsite incineration	8. Offsite incineration	8. Offsite incineration
		9. Removal of materials from tanks, offsite treatment (PACT)
		10. Disposal of tanks (see 4, 5 above)

Use of the Operable Units concept limits the development of alternatives that attain or exceed all applicable and relevant standards. Also, the exclusion of remedial actions for groundwater cleanup due to a lack of data does not permit the development of alternatives that attain or exceed all applicable and relevant standards. Combining alternatives from the three operable units and addressing remediation of the groundwater will allow development of alternatives that attain or exceed applicable and relevant standards. However, this is beyond the current scope of this feasibility study.

The initial remedial action alternatives are developed and screened in the following sections.

2.3.1 Remedial Component 1 - Remediation of Municipal Well No. 7

There are three remedial action alternatives that will be evaluated in this remedial component: No Action, Treatment of Municipal Well No. 7, and Purchase of Water from Passaic Valley Water Commission.

The latter two belong in the "does not attain applicable and relevant public health and environmental standards" ("does not attain") category. Alternatives that attain or exceed applicable and relevant public health and environmental standards ("attains" or "exceeds" categories) would require additional RI work to define all the potential sources of contamination of Well No. 7. The offsite disposal or treatment category is not applicable to this remedial component.

The alternatives in this remedial component are listed below:

- Remedial Action Alternative No. 1 - No Action
- Remedial Action Alternative No. 2 - Purchase of Water from Passiac Valley Water Commission

- Remedial Action Alternative No. 3 - Wellhead Treatment of Municipal Well No. 7

2.3.2 Remedial Component 2 - Remediation of the Downgradient Contaminant Plume

The remedial action alternatives for this remedial component include No Action/Monitoring, and Alternative Water Supply and Sealing Private Wells. The Alternative Water Supply and Sealing Private Wells alternative fits the "does not attain" category. The remaining categories (except "no action") cannot be satisfied for the same reasons provided for Remedial Component 1 in Section 2.3.1.

The components of these alternatives are listed below:

- Remedial Action Alternative No. 4 - No Action/Monitoring
  - Monitor water quality in residential wells within the plume that are not served by municipal supply.
  - Monitor water quality in residential wells on the perimeter of the plume that are not presently contaminated.
- Remedial Action Alternative No. 5 - Alternative Water Supply and Sealing of Private Wells
  - Provide tap-in to municipal supply to all residences within and around the plume that are not currently served by municipal supply.
  - Seal private wells in affected area.
  - Provide for institutional controls on groundwater use in affected area.

2.3.3 Remedial Component 3 – Remediation of Onsite Wastes and Contaminated Soils

The remedial technologies that passed the technical screening are summarized in Table 2-6, which lists the technologies in relation to the exposure pathways and migration routes of concern. In formulating remedial action alternatives, it will be useful to consider the feasible approaches to remediating the leachate migration route from the Central Lagoon Area (CLA) first, and then to consider remediation of the other pathways/routes using similar or compatible techniques.

There are two basic options for reducing leachate from the CLA: capping to minimize infiltration through the contaminated soils, or excavation to remove contaminated soils from the area.

<u>Capping</u>

The effectiveness of multimedia capping in minimizing leachate generation from the contaminated soils is questionable. Because contaminated soils are in close proximity to the water table, they may be below the seasonal high water-table in the western portion of the CLA, and infiltration and groundwater flow along the bedrock surface from the eastern section of the site through the CLA would contribute to leachate generation by an undetermined amount.

The last problem can be addressed by tying the eastern end of the cap to an upgradient diversion barrier extending down to the bedrock. This will minimize flow to the west downdip along the bedrock surface.

The problem of the seasonal high water-table periodically contacting the contaminated soils cannot be easily addressed and would require lowering of the water table to the point where the seasonal high water table does not contact the contaminated soils, and installing a groundwater barrier to minimize lateral groundwater flow through the area or in-situ treatment of the soils that would be periodically below the water table. However, none of these technologies have been found applicable or easily implemented at the site. Also, adding components to the capping option would complicate and increase the cost of implementing the capping technology. This defeats one of its primary advantages, which is to provide an effective, low-cost, and easily implemented solution.

Therefore, multimedia capping may not provide the level of leachate reduction necessary to meet the objective of 10^{-6} risk from ingestion of groundwater downgradient of the site. However, considering that downgradient receptors may be protected through implementation of RAA No. 5 - Alternative Water Supply and Sealing of Private Wells, it may be acceptable to allow some limited (but as yet undetermined) amount of leachate to continue to reach the groundwater. For this reason, an alternative with multimedia capping of the CLA as the primary component will be considered in this FS.

The components of this capping alternative are listed below:

- Remove liquid and sediments from tanks; transport to offsite PACT treatment facility.
- Excavate tanks and dispose in an offsite hazardous waste landfill.
- Cap CLA with multimedia cap, regrade, revegetate.
- Backfill excavated areas with clean material, regrade, and revegetate.
- Cap contaminated surface soils with soil cover, regrade and revegetate.
- Install groundwater monitoring system.
- Fence site.

Excavation

Remedial alternatives involving excavation of the contaminated soils in the Central Lagoon Area (CLA) will provide the most reliable options in reducing leachate from this area to target levels. There will be very little uncertainty, with such an alternative, that enough of the contaminants have been removed or isolated from the environment. The volume of soils to be excavated is relatively small, and adequate area is available on the site for proper handling. However, all such alternatives are affected by the extent of lateral migration within and beyond the CLA. Accordingly, the volume of soils to be handled may increase significantly, a fact which could affect the cost analysis of some of these alternatives and even their viability.

The common components of the excavation alternatives are as follows:

- Remove liquid and sediments from tanks; transport to offsite PACT treatment facility.

- Excavate tanks and dispose in an offsite hazardous waste landfill.

- Excavate contaminated soils and wastes in CLA and contaminated surface soils in NLA and to the west of the CLA.

- Backfill excavated area with clean material, regrade, and revegetate.

Excavation alternatives will be formulated using the technologies applicable to remediating the contaminated soils after excavation. These include

- Disposal in an onsite secure landfill
- Disposal in an offsite secure landfill
- Offsite incineration
- Onsite incineration and solidification

The alternatives for this remedial component are summarized below.

- Remedial Action Alternative No. 6 - No Action

- Remedial Action Alternative No. 7 - Capping

- Remedial Action Alternative No. 8 - Excavation and Disposal in an Offsite Secure Landfill

- Remedial Action Alternative No. 9 - Excavation and Disposal in an Secure Onsite Landfill (with and without low temperature incineration)

- Remedial Action Alternative No. 10 - Excavation and Offsite Incineration

- Remedial Action Alternative No. 11 - Excavation, Onsite Incineration (high temperature) and Solidification

The 11 remedial action alternatives developed in this section are described in detail in Section 3.0.

3.0 DESCRIPTION OF REMEDIAL ACTION ALTERNATIVES

This section describes in detail the remedial action alternatives identified in Section 2.3.

3.1 Remedial Component 1 - Remediation of Municipal Well No. 7

3.1.1 Remedial Action Alternative No. 1 - No Action

If no remedial action is taken under CERCLA, the Township of Fairfield will continue to provide an alternative water supply to replace the capacity that Municipal Well No. 7 used to provide. However, the township may choose to perform well-head treatment instead of purchasing water from the Passaic Valley Water Commission. This will obviously be at the discretion of the township, provided that water quality standards are met. The risk associated with consumption of contaminated water from Well No. 7 will effectively be mitigated.

3.1.2 Remedial Action Alternative No. 2 - Purchase of Water from Passaic Valley Water Commission

In this alternative, the water that the Township of Fairfield is currently purchasing from the Passaic Valley Water Commission will be provided. Again the risk associated with consumption of contaminated water from Well No. 7 will effectively be mitigated.

The costs of this alternative are estimated at $23,690.00 per year, based on $515.00 per million gallons and an average additional water purchase from Passaic Valley Water Commission of 46 million gallons per year. However, if Remedial Action Alternative No. 5 (See Section 3.2.2) is implemented, an additional 15 million gallons per year will be needed to meet the demand created by additional tap-ins to the township's water system. Thus, the projected 61 million gallons per year estimated water purchase will increase the yearly cost to $31,415.00.

3.1.3 Remedial Action Alternative No. 3 - Wellhead Treatment of Municipal Well No. 7

The treatment of the contaminated water at Municipal Well No. 7 was evaluated prior to this study in a Feasibility Study of the water treatment alternatives by Malcolm Pirnie, Inc., under contract to the Township of Fairfield, New Jersey. Various water treatment technologies were evaluated in this study with two technologies passing the initial screening phase: aeration and absorption treatment.

Aeration treatment is based on the transfer of volatile compounds from the water phase into the vapor phase. Two types of aeration systems were considered, diffused aeration and packed column aeration. Diffused aeration achieved contaminant removal by bubbling small gas bubbles through standing water in a basin or tank. Packed column aeration involves the direct contact of large volumes of air with a measured volume of water. Treatment occurs when water is cascaded over packing, while air is blown countercurrent, effectively stripping the volatile contaminants.

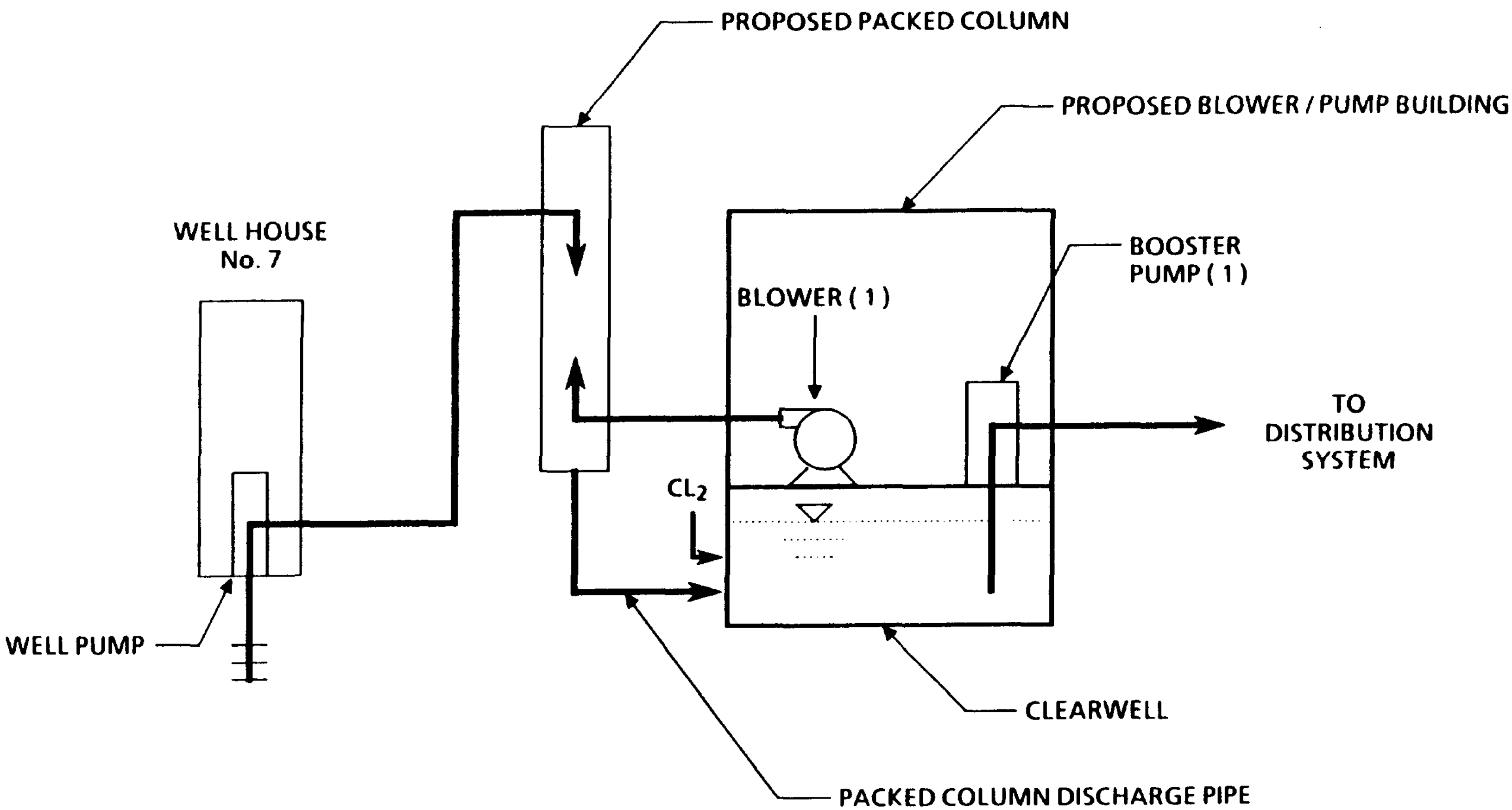
Adsorption treatment removes contaminants from the water by using a carbon or synthetic media which has a greater affinity for the organic contaminants. Three processes were evaluated for adsorption of volatile contaminants. These processes were: powdered activated carbon, granular activated carbon, and synthetic resins. Powdered and granular activated carbons are similar in makeup, however, there are some key differences. Powdered carbon is fine grain carbon, and is added to the water stream to permit maximum liquid contact. The granular media is larger in size and is fixed in place by an adsorber unit, similar in design to a filter. Adsorption by synthetic resins is accomplished in the same equipment used for granular activated carbon adsorption.

Two treatment methods were selected to undergo further study. These methods, one from each of the general categories, include: packed column aeration and granular activated carbon adsorption. Treatability studies were conducted for both methods to determine treatment efficiencies and design criteria for treatment process construction.

Both carbon adsorption and packed column aeration (air stripping) were found to adequately treat the groundwater of Well No. 7. Since only volatile contaminants were found in the groundwater, the air stripping process was determined not to need additional treatment (polishing) by carbon adsorption. Air stripping, the lower cost system, was found to be the most feasible approach for the treatment of Well No. 7 water. Both processes worked equally well, thus cost was used as the deciding factor.

A schematic of the water treatment system is included on Figure 3-1. Water from Well No. 7 will be pumped directly into a packed tower where air blown in from the bottom will effect volatile organic contaminant removal. The water will be discharged into a clear well, disinfected, and then fed into the public distribution system.

This unit can be installed in approximately 12 months at a capital cost of \$275,000.00. The capacity of this system, designed for 425 gpm or 220 million gallons per year, is in excess of past usage. For comparison purposes with Alternative No. 2, the capital and O&M costs for a treatment system that would supply 61 million gallons per year (46 million gallons per year currently and a projected additional 15 million gallons per year needed if Alternative No. 5 is implemented) plus the ability to meet peak summertime demand are estimated at \$222,000.00 and \$7,000.00, respectively. This alternative could also be implemented in 12 months.



SCHEMATIC OF WATER TREATMENT FACILITY
FOR PUBLIC WELL No. 7
CALDWELL TRUCKING CO. SITE, FAIRFIELD TWP., NJ
NO SCALE

FIGURE 3-1

NUS CORPORATION
A Halliburton Company

3.2 Remedial Component 2 - Remediation of Downgradient Contaminant Plume

3.2.1 Remedial Action Alternative No. 4 - No Action/Monitoring

Neither the current nor future risks associated with exposure to contaminated groundwater in the downgradient contaminant plume area will be addressed by this alternative. While many of the residences in the area have been provided with municipal water, some may continue to use private wells for potable and non-potable domestic water. However, the NJDEP will implement restrictions on installing any new wells in this area.

At a minimum, monitoring should be provided in the plume area and on the perimeter of the plume. This will detect contaminant migration over time and alert regulatory agencies to the potential exposure of residents on the perimeter of the plume. Assuming no remedial actions on the plume itself are taken, quarterly monitoring of 18 wells for volatile organics around the plume will be needed because of the proximity of the "fringe" residences to the plume and the possible influence of local pumping on groundwater flow which may cause differential migration in the area of influence of the pumping. The monitoring network is shown in Figure 3-2. The placement of the monitoring points should be confirmed during the design phase of this alternative. This monitoring program may be altered if additional studies on the plume indicate it is needed.

No capital costs are anticipated for this alternative because existing monitoring and residential wells will be used for the monitoring program. The cost of the monitoring program is estimated to be $35,040.00 per year for 30 years.

3.2.2 Remedial Action Alternative No. 5 - Alternative Water Supply and Sealing of Private Wells

Alternative No. 4 deals with mitigating exposure to contaminated groundwater in the plume area.

FIGURE 3-2

PLAN OF MONITORING NETWORK FOR ALTERNATIVE No. 4
CALDWELL TRUCKING CO. SITE, FAIRFIELD TWP., NJ

0 400 800
SCALE IN FEET

NUS CORPORATION
A Halliburton Company

The components of this alternative are discussed below.

Municipal Water Supply

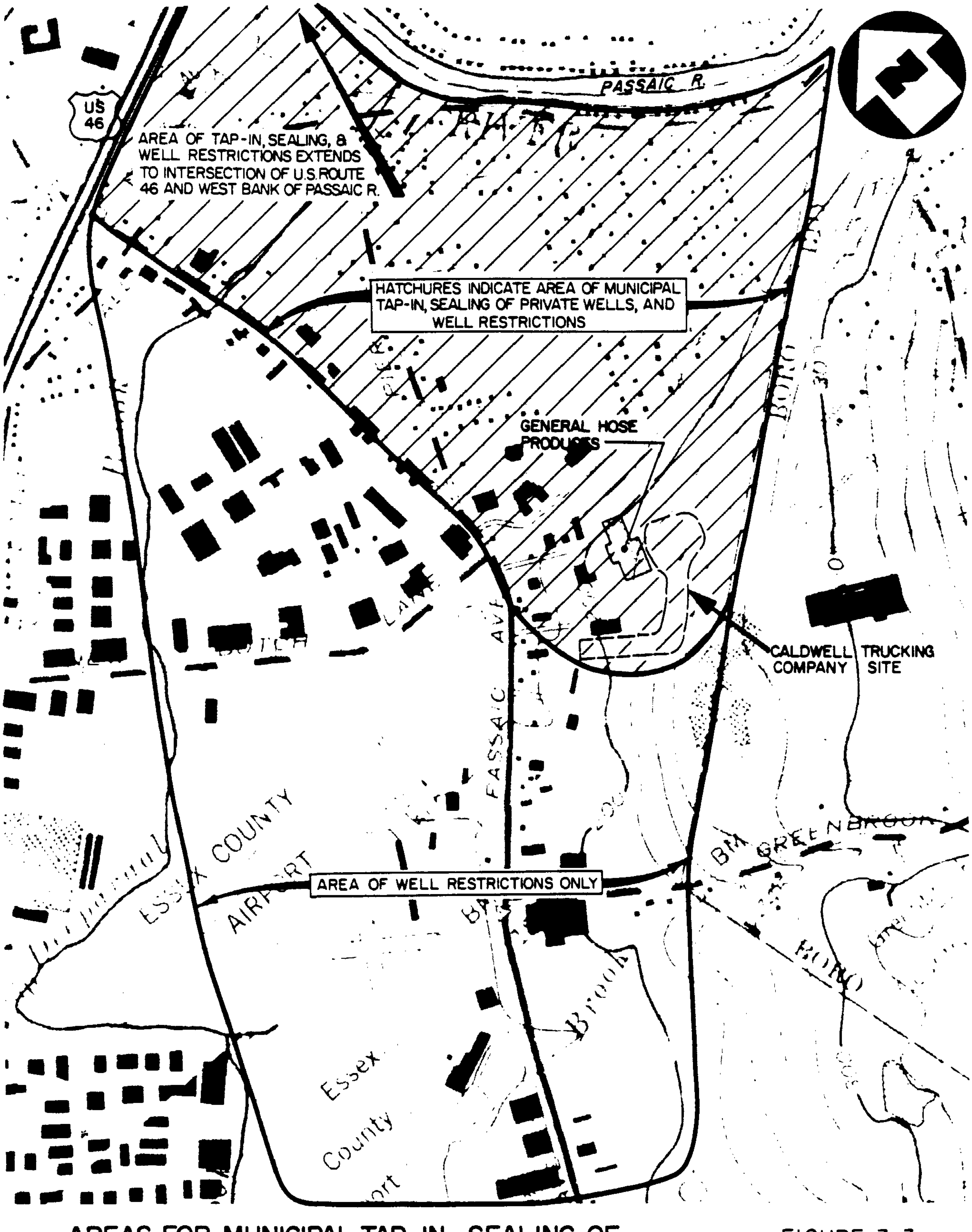
The municipal water distribution system is presently available within the street right-of-ways for the area of concern. The only additions required to the system are the installation of service lines from the street main to the residential buildings. Dwellings not serviced by the municipal water system were identified from Water System Sectional Plots for the Borough of Fairfield. Figure 3-3 shows the boundary that delineates the area of the alternate water supply, based on the extent of groundwater contamination defined in the RI (reference Figure 4-15 of the RI report) and based on the potential for migration of the plume beyond its current limits.

The capital cost per tap-in of new service line includes a curb box and valve, 50 lineal feet of 1-1/2 inch diameter service line, and trenching and backfilling. The estimated construction time for the installation of an estimated 100 service lines is approximately five months.

Sealing of Domestic Wells

The New Jersey Department of Environmental Protection, Division of Water Resources has the power to order the sealing of any abandoned well when, in its judgment, the condition of the well endangers or threatens to endanger the subsurface or percolating waters by the intrusion of salt water or from any other causes, or when it endangers life. A well not in operation for three or more years or improperly maintained to prevent contamination may be deemed to have been abandoned. Thus, New Jersey may have the authority under NJSA 58:4A-4 to enforce the sealing of domestic wells within the limits of the contaminated groundwater plume or the area threatened by the plume.

Figure 3-3 shows the area of concern. Some of the residences with domestic wells are also on the municipal water system. The sealing of these wells shall comply



AREAS FOR MUNICIPAL TAP-IN, SEALING OF PRIVATE WELLS, & WELL USE RESTRICTIONS CALDWELL TRUCKING CO. SITE, FAIRFIELD TWP., NJ

SCALE: 1" = 1000'

FIGURE 3-3

NUS CORPORATION

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with the provisions of the New Jersey Administrative Code 7:9-9 or be by an alternative method approved in writing by the Bureau of Water Control of the Division of Water Resources. The capital cost for sealing the wells is based on a 4-inch-diameter, 100-feet-deep well backfilled with a cement grout. An estimated 10 percent of the wells will not be sealed for monitoring purposes during future studies in the plume area. These wells will be specified during the design phase of the remedial alternative. The construction time for sealing the estimated 90 domestic wells is approximately five months.

Cost

The capital costs associated with this alternative are estimated at $269,480.00. There will be no annual operation and maintenance costs for this alternative.

3.3 Remedial Component 3 - Remediation of Onsite Wastes and Contaminated Soils

3.3.1 Remedial Action Alternative No. 6 - No Action

The no action alternative for onsite soils and wastes will not require implementation of any remedial actions, additional surface or subsurface investigations, or monitoring actions. Site wastes and contaminated soils, routes of offsite contaminant migration, and human and environmental exposure pathways, will continue in their present conditions.

Risks associated with the no action alternative were presented in the Remedial Investigation Report. Table 1-7 lists the estimated lifetime cancer risks associated with site-specific exposure scenarios.

In addition, subsurface soils and wastes are a source of groundwater contamination via the infiltration of precipitation and the leaching of hazardous constituents to groundwater. Table 1-7 shows the present risks associated with the various exposure pathways and routes of migration for the site. Contaminants detected in onsite soils may also impact environmental receptors.

3.3.2 Remedial Action Alternative No. 7 - Capping

The intent of Remedial Action Alternative 2 is to provide primarily a source control remedy. Source control measures include the removal and treatment of the materials in the onsite storage tanks, the removal and off site disposal of the storage tanks, the installation of a compacted soil cap over the areas with contaminated surface soils, and the installation of a multimedia cap over areas with subsurface soil contamination. The capping of contaminated surface soils will also prevent migration of these soils from the site via surface runoff and wind erosion.

Infiltration through the multimedia cap will continue to occur in the CLA only at a significantly lower rate. Although the manufacturers of synthetic membranes have found and recent studies have shown that clay and/or synthetic liners leak, the amount of leachate generation due to infiltration through the cap is expected to be negligible. However, contaminated subsurface soils in contact with the seasonal high groundwater table will continue to contribute to leachate generation in the capped area. The risks to receptors downgradient of the site cannot be estimated with any degree of confidence. However, implementation of Remedial Action Alternative No. 5 - Alternate Water Supply and Sealing of Private Wells would eliminate receptors of the groundwater contamination and effectively mitigate this risk.

The components of the alternative as described in Section 2.3 are discussed in detail below.

<u>Disposal of Tank Contents</u>

Liquids and sediments will be removed from the onsite tanks and hauled to the nearest EPA-approved PACT treatment facility. For costing purposes, the liquids and sediments are assumed to be pumpable and treatable at the DuPont facility in Deepwater, New Jersey; however a sample of the material must be submitted to the facility before bulk shipment is made to verify the waste's compatibility with the PACT process. There are an estimated 19,500 gallons of liquids and sediments in the tanks based on information obtained in the RI and the assumption that the buried storage tank that was not accessed and sampled during the RI is full of contaminated water similar to the other tank contents. This is therefore a conservatively high estimate of the volume of tank contents.

Disposal of Tanks

All of the tanks are located below grade. Three of the tanks are steel, and one is reinforced concrete. The logistics of the remedial alternative will make decontamination of the tanks difficult, and the salvage value may not offset the costs of decontamination. However, this aspect of the alternative can be easily adjusted during subsequent phases of development of the remedial action. Thus for costing purposes in the FS the steel tanks (assumed to be hauled intact) and the concrete tank (assumed to be dismantled in large pieces that can be loaded onto a truck) will be hauled to the nearest EPA-approved landfill in trucks. The CECOS facility in Buffalo, NY was selected for costing purposes. However, the actual disposal facility will be determined by the EPA at the time of site remediation.

Capping of Contaminated Surface Soils

Contaminated surface soils in the North Lagoon Area (NLA) and to the west of the Central Lagoon Area (CLA) will be covered with a 24-inch-thick cap constructed of compacted clean soils. This thickness will ensure adequate immobilization and isolation of the contaminated surface soils beneath. The NLA has an estimated 15,700 square feet of contaminated surface soils and the CLA has an estimated 37,000 square feet of contaminated surface soils (Figure 1-6). The 24-inch-thick soil cap will be constructed of 18 inches of local borrow soils and 6 inches of topsoil to support vegetative growth. The soil cap will require annual inspections and/or maintenance. The estimated cost of operation and maintenance (O&M) is based on 3 percent of the direct capital cost to install the cap and the effort of two technicians for 3 days on an annual basis for the next 30 years.

Capping of Contaminated Subsurface Soils

Contaminated surface and subsurface soils in the CLA will be covered with a multimedia cap intended to reduce the amount of infiltration and leachate generation from the soils. The multimedia cap is about 6-feet thick and has a unit weight of about 670 lbs/sf.

Part of the CLA to be capped includes an existing lagoon filled with partially dried septic wastes. The reported moisture content of the waste is about 60 percent. The waste lagoon may not be able to support the multimedia cap or the construction activities associated with installation. The stability of the waste could be increased, if need be, with commercial products or onsite borrow materials. Since no geotechnical information is available on the stability or bearing capacity of the waste, it is assumed that the waste will support the weight and construction of the multimedia cap. The capital costs for the multimedia and soil caps are based on the areas shown previously in Figure 1-5. However, additional subsurface investigations will be necessary to define the extent of subsurface soil contamination beyond the limits shown. The O&M costs for this task are based on annual cap repairs of 3 percent of the direct capital costs of installation and an annual inspection requiring two technicians for two days.

Erosion Controls

Provisions to reduce stormwater runon and offsite migration of contaminated soils via run-off and wind erosion will be required during remediation. Silt fencing around the perimeter of the site should be adequate to control sediment migration via runoff. Revegetation and regrading of the entire site will minimize erosion after site activities are completed.

Fencing

A chain-link fence will be needed after completion of the remedial action to minimize damage to the capped and revegetated areas.

Monitoring

Post closure monitoring will be performed to determine the effectiveness of the remedial action and as required by applicable regulations. Existing monitoring wells 4, 4A, 3A, CT-MW-3, CTBR, and CT-MW-1 can be used to monitor groundwater upgradient and downgradient of the CLA. For costing purposes, four monitoring wells will be sampled semi-annually and the samples analyzed for volatile organics and PCBs. The actual wells can be selected in subsequent phases of development of the remedial action.

Cost

The capital costs for this alternative are estimated at $740,485.00. Annual operation and maintenance costs are estimated at $18,120.00. These costs assume Level D respiratory protection with dermal protection for onsite work. The estimated time to implement this alternative is 6 months.

3.3.3 Remedial Action Alternative Nos. 8 through 11 - Excavation Alternatives

As indicated in Section 2.3.3, there are several common components to all of these alternatives. They will be addressed first and not repeated. The alternatives will then be addressed individually according to the specific disposal or treatment options for the contaminated soils.

The intent of the excavation alternatives is to provide actions for both source control and management of migration. The primary emphasis, however, is on removal of the contaminated material from the environment as a source control measure. As such, it will effectively remove contaminants from the environment to the extent necessary to mitigate the detrimental effects recorded during the RI. The major advantage is that the level of remediation is verifiable to a much greater extent than the capping alternative. Thus, soils/wastes can be removed until on site testing determines that the action levels (see Table 1-9) have been achieved.

Estimates of risks from volatile organic and contaminated particulate emissions during excavation do not indicate a public health problem (see Table 1-7). The level of protection anticipated during excavation is expected to be Level D respiratory protection with dermal protection. The costs for onsite work assume Level D protection.

A key issue for all the excavation alternatives is the extent of subsurface soil contamination on the site. This will affect the volume of materials to be removed and disposed or treated, which will affect the cost associated with each of these alternatives. The quantities used for costing herein are based on the contaminated areas defined during the RI. The limits of these areas should be verified before implementation of the excavation alternatives.

The common components of the excavation alternatives are described in detail below.

Disposal of Tank Contents

Liquids and sediments will be removed from the onsite tanks and hauled to the nearest EPA-approved PACT treatment facility. For costing purposes, the liquids and sediments are assumed to be pumpable and treatable at the DuPont facility in Deepwater, New Jersey; however a sample of the material must be submitted to the facility before bulk shipment to verify the waste's compatibility with the PACT process. There are an estimated 19,500 gallons of liquids and sediments in the tanks.

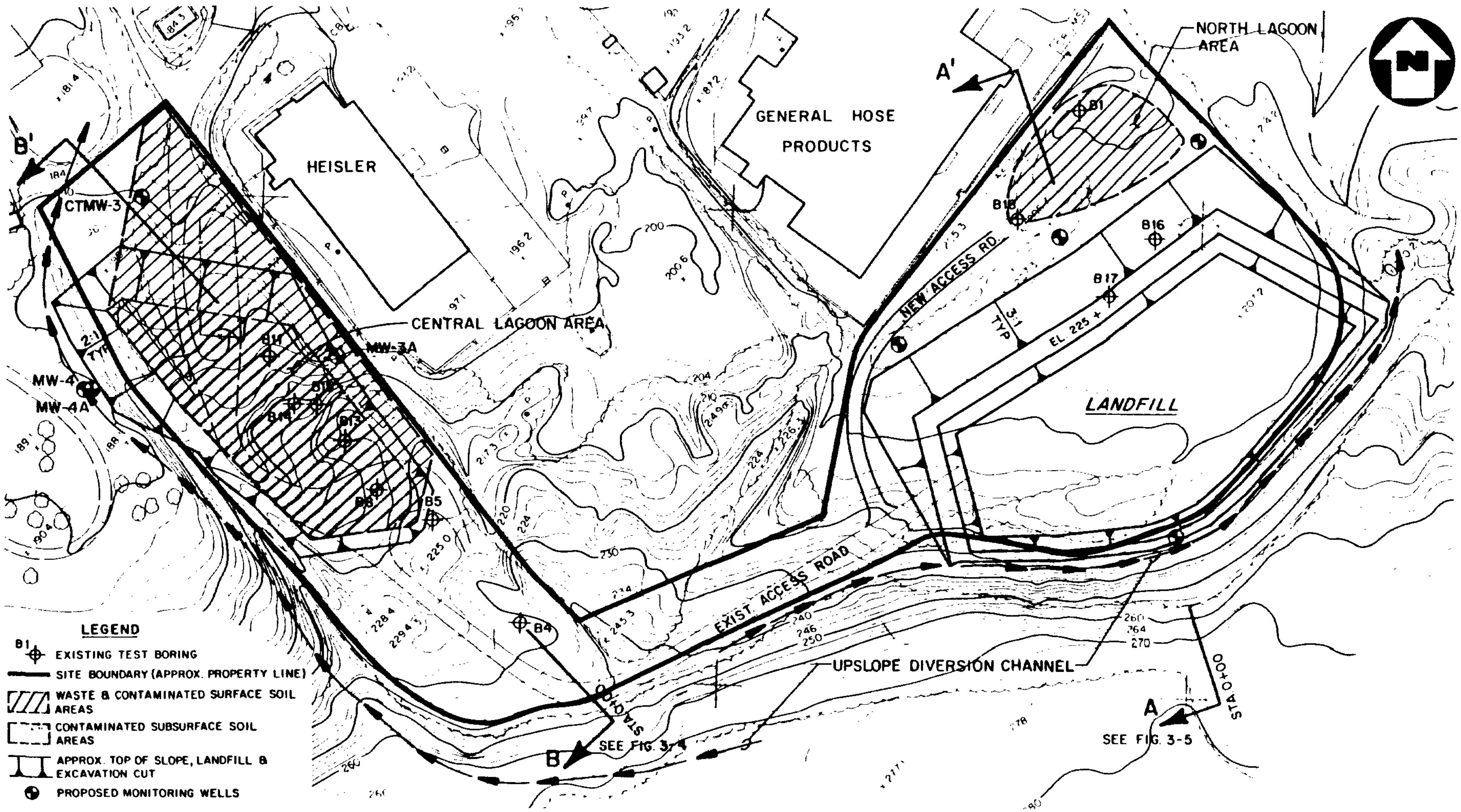
Disposal of Tanks

The tanks will be removed and taken to an offsite, EPA-approved landfill fc disposal, except for the onsite landfill alternative, within which they will bi disposed onsite. All of the tanks are located below grade and will require limited excavation operations. Three of the tanks are steel, and one is reinforced concrete. The logistics of the remedial alternative will make decontamination of the tanks difficult, and the salvage value may not offset the costs of decontamination. However, this aspect of the alternative can be easily adjusted during subsequent phases of development of the remedial action. Thus, for the purposes of the FS, the steel tanks (assumed to be hauled intact) and the concrete tank (assumed to be dismantled in large pieces that can be loaded onto a truck) will be hauled to the nearest EPA-approved landfill in trucks. The CECOS facility in Buffalo, New York was selected for costing purposes. However, the actual disposal facility will be determined by the EPA at the time of site remediation.

Excavation of Contaminated Soils

Contaminated surface soils near the CLA and in NLA will be excavated to a depth of 1 foot. Contaminated subsurface soils and waste sludges in the CLA will be excavated to bedrock. The estimated total volume of contaminated materials is approximately 28,000 cubic yards. The excavation plan and cross-section are shown in Figures 3-4 and 3-5.

The rationale behind the determination of the 3-dimensional limits of excavation is based on an analysis of the available RI site data and has been explained previously. The volume of site material for excavation was calculated by projecting a vertical plane from the designated surface limits of contamination, to a depth of from 1-foot to bedrock. Additional "clean" soils shall be excavated from the side slope cuts and are proposed to be backfilled into the excavation cut after the contaminated materials are removed.

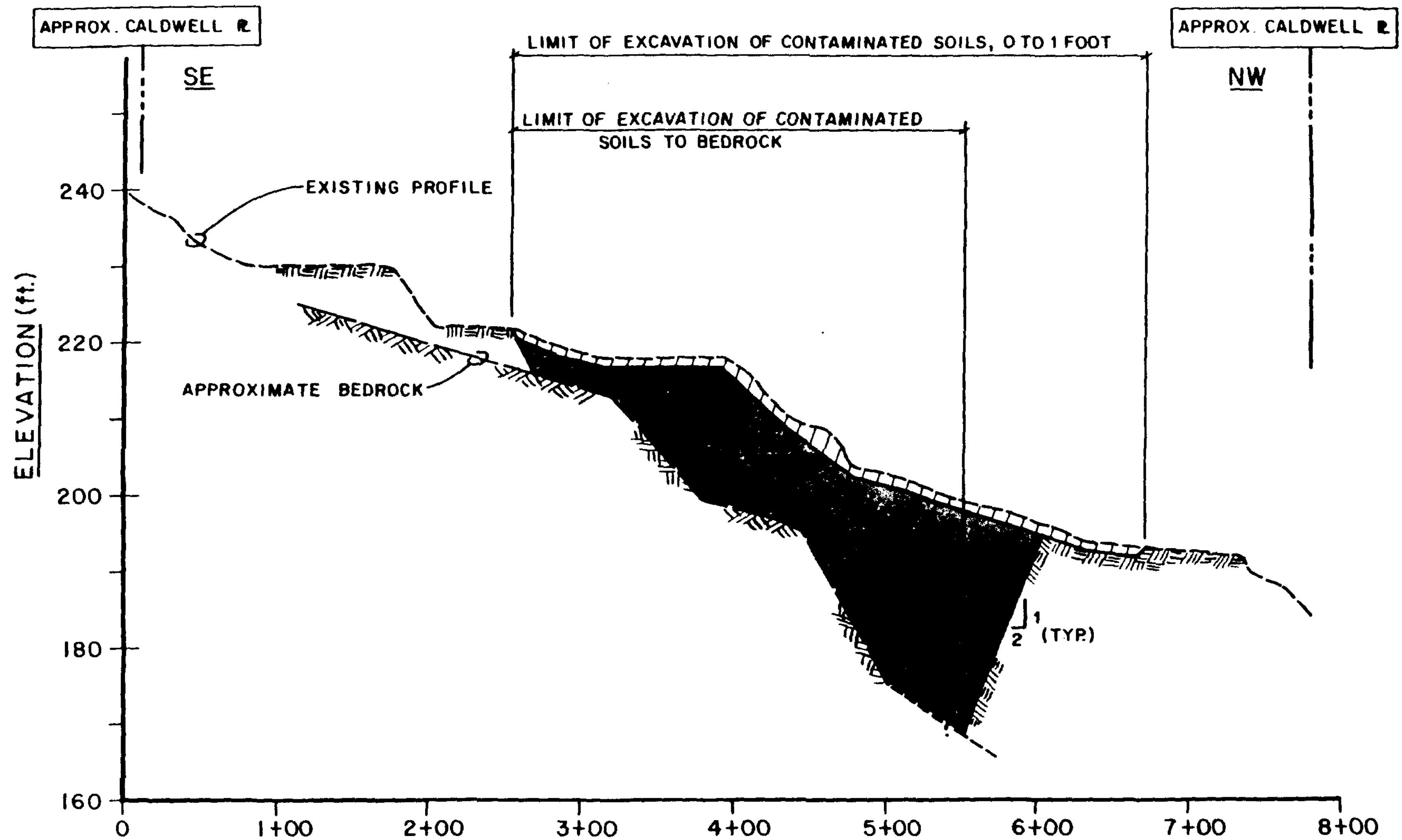


CTC 001 1200

FIGURE 3-4

ONSITE LANDFILL AND EXCAVATION PLAN
CALDWELL TRUCKING CO. SITE, FAIRFIELD TWP., NJ

NUS CORPORATION
A Halliburton Company



SECTION B-B'

SEE FIGURE 3-3

FIGURE 3-5

ONSITE CONTAMINATED SOIL EXCAVATION
CALDWELL TRUCKING CO. SITE, FAIRFIELD TWP., NJ

NUS CORPORATION
A Halliburton Company

Approximately 28,000 cubic yards of clean fill will be required to bring the excavation cut back to approximate original grade except in the onsite incineration and solidification alternative where the treated soils will be used as backfill. Because the site property area is limited, presumably backfill material will be obtained from offsite sources. There are potential onsite or adjacent property borrow areas; however, sufficient subsurface data are not available to develop a comprehensive site grading plan.

Erosion Controls

Provisions to reduce stormwater runon and offsite migration of contaminated soils via runoff and wind erosion will be required during remediation. Silt fencing around the perimeter of the site should be adequate to minimize sediment migration via runoff. Regrading and revegetation over the entire site will minimize erosion after completion of site activities.

The disposal/treatment options for the excavation alternatives are discussed in detail in the following sections.

3.3.3.1 Remedial Action Alternative No. 8 - Excavation and Disposal in an Offsite Secure Landfill

In this alternative, all contaminated materials, except the tank contents, will be hauled to a licensed Hazardous Waste Management Facility (HWMF), such as the CECOS facility in Buffalo, New York or the Fondessey HWMF near Toledo, Ohio. The CECOS Facility was chosen for costing purposes. The actual disposal site will be selected by the EPA if and when this alternative is implemented.

If excavated to the previously established action levels and backfilled with clean material, the site will be remediated to target risk levels ($<10^{-6}$) to the surrounding populations. Thus, after regrading and revegetation, the site will require minimal maintenance, semi-annual monitoring, and possibly fencing to limit access. Existing monitoring wells around the site can be used for monitoring as in Alternative No. 6.

The capital costs for this alternative are estimated at $18,188,207.00 with annual operation and maintenance costs estimated at $26,200.00. Estimated time to implement this alternative is 8 months.

3.3.3.2 Remedial Action Alternative No. 9 - Excavation and Disposal in an Secure Onsite Landfill

Landfill Construction

This alternative will be initiated with construction of an onsite landfill. The preliminary location selected is on the far eastern end of the site property. The landfill, including embankments, encompasses an approximately 3.4 acre area. Dimensions are roughly 300 by 500 feet. Capacity is approximately 30,000 cubic yards.

Because of the limited property on the eastern site area. The landfill has been designed to abut the southern slope. This necessitates encroachment onto the adjoining property, presently owned by the Fairfield Township School District. The landfill plan is presented on Figure 3-4. The landfill design presented here is preliminary and subject to detailed design considerations being evaluated during the design phase of the remedial alternative.

The landfill design is the impoundment type, which uses a continuous perimeter embankment for containment of the waste materials. This design was selected because of uncertainties about the structural stability of the fill, especially with the proposed disposal of semi-solid sludges and containers. A retaining embankment ensures containment of the waste materials and any generated liquid leachates.

The proposed site area is an undeveloped portion of the site property. Subsurface material consists of approximately 20 to 30 feet of dense glacial tills overlying a fractured basalt bedrock. Test boring TB-17 confirms the subsurface stratigraphy. The water table is estimated to be 15 to 20 feet below ground surface as inferred from site conditions in the area of monitoring wells 3, 3A, 4, and 4A on the southern end of the site.

The landfill design is based on NJDEP Hazardous waste regulations, outlined in N.J.A.C. 7:26-10.8. The landfill liner and cap design is shown in Figure 3-6. Additional landfill siting criteria are contained in N.J.A.C. 7:26, Sections 13.8 to 13.13. The proposed landfill site does not meet certain siting criteria, including the following:

- The site is not beyond 1 mile of a water supply well or well field producing more than 100,000 gallons per day (assuming the Town of Fairfield Well No. 7, at 0.28 MGD, is operating).

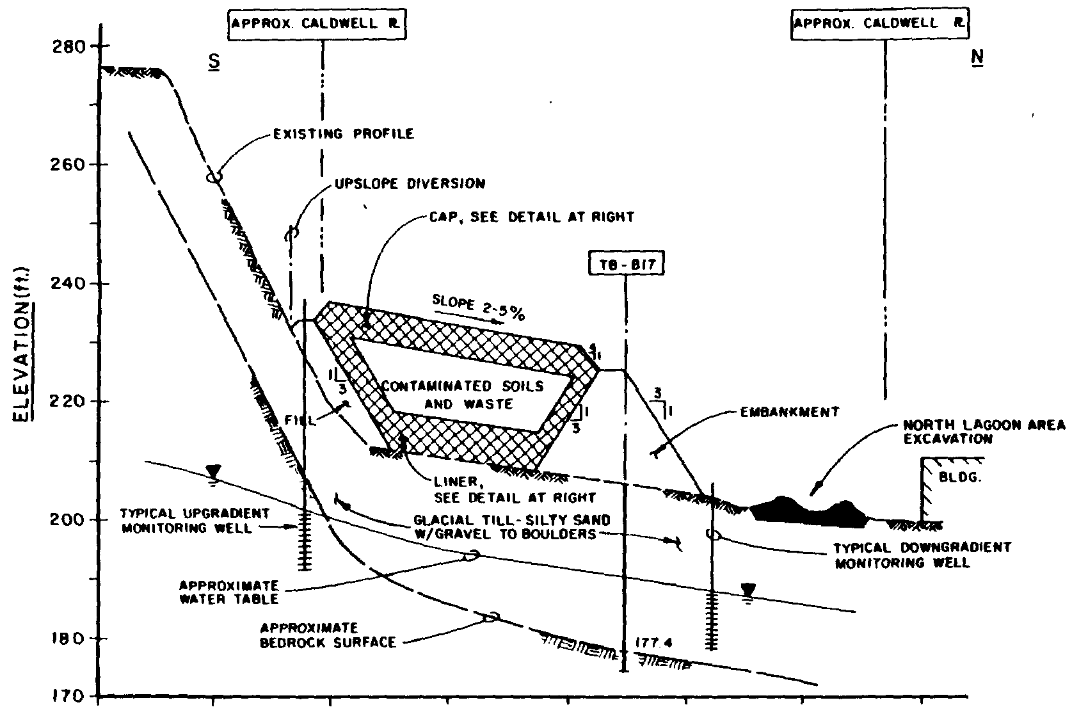
- Waste disposal activity will occur within 200 feet of the property boundary (adjoining property is encroached and acquisition or leasing of additional property is required).

The initial site activities will involve clearing and grubbing vegetation in the 3.4 acre landfill area. The landfill site is a likely borrow area for embankment material and will be excavated for fill after it has been cleared. Topsoil should be stockpiled for later use for the final cover.

The borrow area will be excavated, as required, to a subbase grade of 2 to 5 percent. Embankments will be constructed concurrently with borrow excavation to minimize stockpiling. Subbase drains should be placed at the toe of the existing slope, if required, to collect and divert groundwater seepage.

The embankments will be a side slope fill on the south edge of the landfill and a full-standing fill on the remaining perimeter areas. Embankment height will be

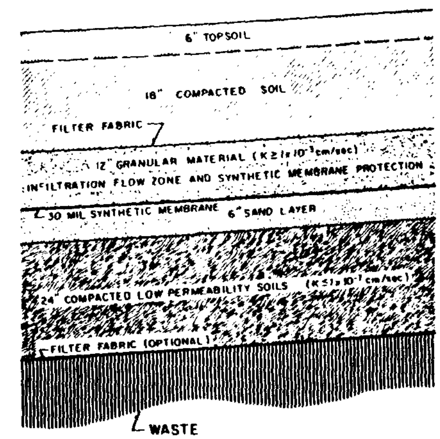
NOTE: SITE SUBBASE EXCAVATION FOR EMBANKMENT FILL NOT SHOWN. BORROW AREA SUITABILITY WILL BE DETERMINED AFTER ADDITIONAL SITE INVESTIGATIONS DURING DESIGN.



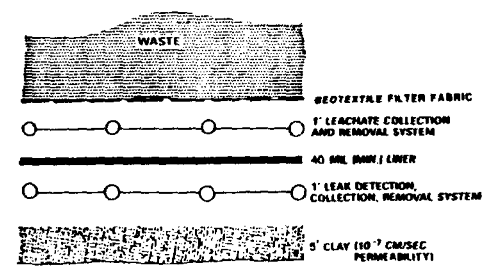
SECTION A-A'

SCALE 1" = 100' H, 20' V

SEE FIGURE 3-3



TYPICAL
LANDFILL CAP
NTS



TYPICAL
LANDFILL DOUBLE LINER
NTS

REF: NJAC 7:26-10.8(i)

FIGURE 3-6

CTC 001 1205

ONSITE LANDFILL SECTION & DETAIL
CALDWELL TRUCKING CO. SITE, FAIRFIELD TWP., NJ

NUS CORPORATION
A Halliburton Company

approximately 15 to 18 feet. Total embankment fill is approximately 20,000 cubic yards. An upslope diversion channel will be placed into the side hill embankment berm to convey stormwater runoff away from the disposal cell.

The next stage of construction is placement of the double liner system. The liner will cover a projected area of approximately 75,000 square feet. The liner and the final cap both use clay for containment of the wastes. The clay source has not been determined at this time, although an off site borrow is expected because of the lack of suitable clay onsite.

The secondary liner will be placed first on the finished landfill embankments and subbase. Typically, this layer will consist of 5 feet of clay with a permeability of less than 1×10^{-7} centimeters per second. The clay will be placed in maximum 12-inch-thick lifts and be compacted with a steel tamping foot-type roller. Site quality control testing will be used to check the density of the clay to assure that the minimum design specification is achieved.

A 1-foot-thick, fine aggregate layer will be placed directly on top of the clay to serve as a leachate detection zone. Perforated collection pipe will be placed within the detection zone and will be drained to an onsite leachate storage tank.

The primary liner will typically consist of a 40 mil synthetic membrane placed directly on top of the detection zone. The specific liner material will be determined during the design phase, after a thorough investigation of material properties and waste compatibility. Candidate materials include PVC, polyethylene, and hypalon.

An additional 1-foot-thick, fine aggregate layer will be placed directly on top of the synthetic membrane to act as a leachate collection zone. Perforated collection pipe will be placed within the collection zone and will be drained to an onsite leachate storage tank. A geotextile filter fabric will be placed on top of the leachate collection zone to minimize transport of fines into the collection system.

Once the landfill cell and liner have been constructed, waste material disposal can commence. A total waste fill volume of 28,000 cubic yards is estimated.

Initial activities for the waste and contaminated soil excavation action include construction of an upslope diversion channel and downslope silt fence and upgrading of the existing access road to the landfill area. The extent of the site excavation operations has been described in Section 3.3.3 and is not repeated here. The excavation plan is shown on Figure 3-4.

Contaminated Soil Deposition

All excavated materials will be hauled on the existing site access roads to the landfill area, a one-way distance of approximately 1,000 feet. A ramp will be constructed from the access road to the disposal cell embankments to allow haul trucks to end-dump materials into the disposal cell. One or more bulldozers, as required, will operate in the landfill cell to spread and compact the waste materials.

Soil materials will be spread in thin lifts and compacted. Bulk materials, such as containers or boulders if placed in the landfill, will not be placed directly on the liner. These items will be temporarily stockpiled near the excavation area, until a minimum 4 feet of soil fill has been placed on the liner. Bulk materials will be spread horizontally throughout the fill, as practicable, to minimize the concentration of these items in one part of the cell. This is expected to reduce the potential for future differential settlement of the landfill cap.

Landfill Closure

After all of the excavated materials have been placed to approximate final grade, the landfill cap will be constructed. The cap will be a multi-media design containing two low permeability layers: 2 feet of compacted clay and an upper 30 mil synthetic membrane. A 12-inch granular material flow zone will be placed on top of the synthetic membrane to drain infiltration. A final 24-inch soil cover, consisting of 18 inches of compacted soil and 6 inches of topsoil, will be placed on top of the flow zone and will be vegetated.

A 6-foot chain-link fence with a locking gate will be constructed around the landfill perimeter to restrict site access. Ongoing maintenance and monitoring of the landfill is proposed for a minimum 30 year period. A groundwater monitoring and post-closure plan will be prepared in accordance with RCRA hazardous waste regulations.

Monitoring

Four shallow wells are proposed for groundwater monitoring of the onsite landfill as shown on Figure 3-4. These include one placed hydraulically upgradient and three placed hydraulically downgradient.

Each well will penetrate the water table approximately 10 feet. The wells will be sampled quarterly for EPA HSL volatile organic compounds and PCB.

Post-remedial monitoring will be performed in addition to monitoring for the onsite landfill alternative. The post-remedial monitoring will confirm the effectiveness and long-term reliability of the site contamination cleanup in preventing an increase in groundwater contamination.

Four wells are proposed for post-remedial monitoring. Existing wells 4, 4A, CT-MW-3, CTBR, and CT-MW-1 may be suitable for post-remedial monitoring of the CLA. MW-3A may not be suitable as it may be damaged or destroyed during excavation. Four of these wells will be monitored for HSL volatile organic compounds semi-annually for a period of 30 years.

Cost

The estimated capital costs for this alternative are $3,166,433 with annual O&M costs of $41,000.00. The estimated time to implement this alternative is 12 months.

Additional Safeguard - Low Temperature Volatilization

As demonstrated in this section, a landfill can be constructed on the site in accordance with RCRA-approved concepts. However, to compensate for any possible shortcomings in locating a landfill at this particular site, e.g., its proximity to neighboring property or receptors, some of the constituents of the contaminated waste fill can be reduced by first applying a low temperature volatilization process (developed by EPA) between the excavation and deposition steps. This pretreatment process would eliminate the most mobile of the hazardous constituents which normally present the greatest risk to a landfill.

Under this system, the excavated material is screened to segregate the boulders and larger rocks which can eventually be backfilled into the open pit. Smaller rocks would be crushed and the screened material fed into a low temperature drying unit (rotary kiln, moving belt, fluid-bed, or similar purpose equipment) with sufficient heat, but below combustion temperature (approximately 160°F), to vaporize all the volatiles, reduce the moisture content and effect partial sterilization. Typically the exhaust gases might be passed through a knock-out drum to remove the water and then into a carbon adsorption filter where the organics would be trapped along with any odors. In short, a significant portion of the contaminants feeding the groundwater plume could be removed, as indicated below, at a very reasonable cost.

As originally conceived, the semi-clean soil (left with only the more immobile organics and metals) was to be solidifed to reduce its permeability to less than 1×10^{-7} cm/sec., backfilled into the excavated areas and capped. The uncertainty with this system was putting the solidified material back into the excavated areas where it would be once again in direct contact with the undisturbed soil and bedrock, where any eventual leaching would take place unhindered. Thus onsite landfilling according to RCRA requirements was chosen as the companion technology.

In the design stage, a detailed cost estimate can be developed for this pretreatment loop which would allow a more definitive cost/benefit analysis to be made. However, based on rough calculations, the cost to provide a skid-mounted system, and to operate it for one year would be $500,000. Use of second-hand equipment might reduce the cost of the equipment by 30 to 50 percent, while the overall cost (equipment plus labor) would drop to approximately $390,000 (30 percent reduction in equipment cost). These preliminary costs indicate that this pretreatment step would be a worthwhile addition to Remedial Alternative No. 9 and hence will be shown in the final summary on Table 4-1. Use of this process might add 3 months to the overall implementation time for this alternative.

3.3.3.3 Remedial Action Alternative No. 10 - Excavation and Offsite Incineration

This alternative involves source control actions (excavation) that will eliminate all of the present, potential, and future unacceptable risks at the site. This alternative employs complete excavation of contaminated soils and wastes, as identified previously. Therefore, further description and evaluation of excavation will not be included in this section.

The waste materials are destroyed (via incineration) and the remaining ash is disposed properly by the operators of the offsite incinerator. The offsite incinerator will be a permitted facility under RCRA. Potential offsite incineration facilities include Rollins Environmental Services of Bridgeport, New Jersey, and SCA Chemical Services of Chicago, Illinois. For costing purposes, Rollins Environmental Services was chosen. The final selection of an offsite incineration unit will be made by EPA at the time of remediation. The availability of an offsite incineration facility is uncertain at this time because of a large backlog of wastes and limited loading capacities of approximately 1 to 2 tons per hour. The time to implement this alternative, at this treatment rate, is approximately 3 to 6 years.

Post-remedial-action groundwater monitoring, as described for Remedial Action Alternative No. 2, will be conducted to determine the effectiveness and long-term reliability of the soil and waste removal action.

The estimated capital costs for this alternative are $49,056,421.00 with annual O&M costs of $26,200.00

3.3.3.4 Remedial Action Alternative No. 11 - Excavation, Onsite Incineration and Solidification

After excavation, contaminated soils will be staged onsite to await treatment by incineration and solidification. The incineration of the soils will be accomplished by the use of a mobile incineration system. Treated soils will then be solidified onsite before being disposed onsite. A schematic for the treatment sequence is shown on Figure 3-7.

Incineration

A mobile incineration system was evaluated, as opposed to a permanent system, because such systems have been developed (one contractor has three units currently available) and permitted under TSCA and RCRA. The construction of an incinerator for use at a CERCLA site has not been established as a viable option for soil/waste volumes less than 100,000 cubic yards.

Currently, only one company has a fully operating and permitted unit available to the market. This unit was used for design and costing purposes. The unit can be driven to the site, set up, and begin soil decontamination, all within a relatively short period of time. The mobile unit incorporates the use of a well-established incinerator, the rotary kiln, and all of the necessary ancillary equipment, including water treatment. The incineration system can decontaminate 4 to 5 tons per hour

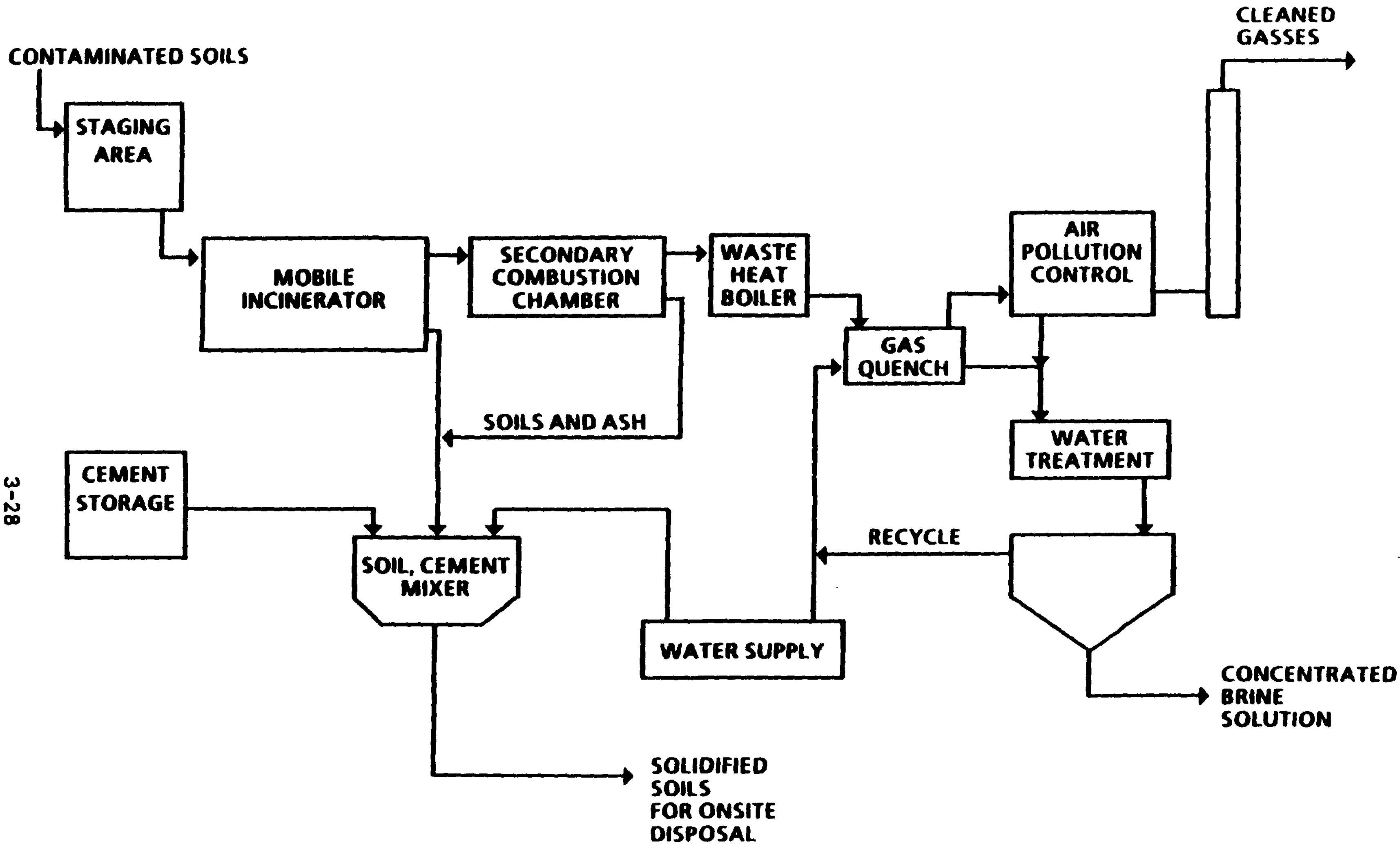


FIGURE 3-7
SOIL INCINERATION AND SOLIDIFICATION SCHEMATIC

of the contaminated soils. The temperature within the rotary kiln, approximately 2000°F will be sufficient to either destroy or drive off all of the organic contaminants. The volatilized contaminants that are not destroyed in this chamber will be treated at nearly 2300°F in the secondary combustion chamber. The resulting soils and ash will be solidified onsite to permit disposal onsite.

Solidification

A 50:50 mixture of soil to portland cement was used to evaluate the cost of onsite soil solidification. This mixture was determined from literature sources and should not be used as a basis for conceptual or final design. Some of the items to be established prior to design include but are not limited to

- An evaluation of soil grain size.
- The determination of expected ash content of the soils following incineration.
- Evaluation of compatible solidification matrices and "recipes".
- An evaluation of the resulting mass to determine leachability.

The actual solidification process is a simple technology that will require little development and design. Cement, soil, and water will be mixed in one or more onsite blending mills to form a solidification mass. The resulting mixture can then be cured, in a adjacent area or in place, to permit maximum leach resistance.

Once in place, the solidified mass must be covered with a minimum of 3 feet of cover material to prevent damage to the matrix by frost. Other than that, periodic testing should be all that is required to ensure the integrity of the solidified mass over time.

Onsite Disposal

The soil/cement mixture can be used as backfill material in the excavated areas on the site. However, the increased volumes of treated soil will require additional disposal space. This can easily be found in the area which abuts the highwall on the eastern end of the site. This area can be excavated for borrow material which will be staged for later use as final cover. The soil/cement mixture can be deposited in the excavated area below and subsequently above grade, building gradually out from the high wall. When treatment and deposition have been completed, the borrow material can be used as final cover material for the backfilled areas.

Monitoring

Monitoring well placement will be similar to that recommended for the onsite landfill alternative. Monitoring for inorganics only will be on a semi-annual basis.

Cost

The capital cost of this alternative is estimated at $42,463,335.00. Operation and maintenance costs are estimated at $26,200.00 per year. The estimated time to implement this alternative is 2.5 years.

4.0 DETAILED EVALUATION OF ALTERNATIVES

4.1 Alternatives Evaluation Method

The remedial alternatives identified in Section 3.0 have been evaluated in detail using the following criteria:

- Technical Evaluation
- Public Health and Environmental Concerns
- Institutional Issues
- Cost

These criteria are described individually in the following subsections.

4.1.1 Technical Evaluation

Performance, reliability, implementability, and safety of each alternative are considered under the technical evaluation section.

Performance is based on

- Effectiveness - The ability of the remedial action alternative to perform intended functions, as determined through design specifications or by performance evaluation, will be included in the effectiveness evaluation.

- Useful Life - The projected service life of a remedial action alternative's component technologies, the resource availability in the future life, the deterioration of a technology, and resultant changes in effectiveness will be included in the useful life evaluation.

Reliability is based on

- Operation and Maintenance (O&M) Requirements - Technology components of remedial action alternatives will be assessed for frequent or complex O&M requirements and the associated costs.

- Demonstrated Performance - Technology components of a remedial action alternative will be assessed by qualitative and/or quantitative terms for probability of failure. A bench test study will be recommended for innovative technologies without a proven data base.

Implementability, the relative ease of installation and time required to achieve a given level of response, is based on

- Constructability - The ability to actually build, construct, or implement the remedial action alternative will be assessed, along with site conditions and external factors that influence the assessment.

- Time - The time required to implement or construct the remedial action alternative and the time required to achieve beneficial results will be assessed in quantitative and qualitative terms, respectively.

The safety evaluation includes the assessment of long-term and short-term threats to the safety of nearby communities, local environs, and site workers.

4.1.2 Public Health and Environmental Concerns

Each alternative was evaluated for its degree of public health and environmental protection. The public health evaluation focuses on the effects of each remedial alternative on eliminating the unacceptable health risks associated with the site contaminant exposure pathways. These pathways and corresponding health risks have been described in Section 1.0. The adverse effects of construction-related activities on the public are considered, as well as the likely public reaction to the alternative.

The environmental evaluation addresses the effects of each remedial alternative on eliminating the unacceptable risks to the environment from the site contaminant exposure pathways. Construction-related impacts are also considered.

4.1.3 Institutional Issues

Institutional issues refer to regulations that establish practice or performance standards applicable to the remediation of the site. These regulations might be Federal, State, or local. They have been detailed previously in Section 2.1.3.

Since issues relating to groundwater remediation have been deferred to a future time after additional studies have been completed, none of the alternatives evaluated herein will meet requirements for groundwater remediation. This is pointed out here and will not be repeated in the individual alternative evaluations.

4.1.4 Cost Criteria

The alternatives have been analyzed to estimate the costs for implementation of the remedial action alternative.

The development of cost analysis involves the following:

- Capital Cost Estimation
- Operation and Maintenance (O&M) Cost Estimation
- Sensitivity Analyses
- Present Worth Analyses

Baseline Cost Estimates

Capital Costs are expenditures initially incurred to develop and implement a remedial action. Capital costs consist of direct and indirect costs.

The estimating method considered unit costs and construction quantity estimates. Unit costs were assigned to the work quantities, considering the materials required, the types of equipment to be employed, and the construction difficulty expected. Labor and equipment costs are adjusted to reflect construction difficulty and diminished productivity associated with higher levels of health and safety protection required for hazardous work items.

O&M Costs are costs required to operate and maintain the remedial action throughout an average useful life.

Cost Analyses

Sensitivity Analyses are conducted to evaluate the effect of varying specific assumptions on the estimated cost of the remedial action. By varying the parameters, the sensitivity of costs to uncertainties associated with assumptions can be assessed. Results are used to identify the worst case and the optimistic scenario. Sensitivity Factor sheets show the quantity and cost factors that were varied.

Present Worth Analyses discount expenditures that occur over different time periods to the present year. A 30-year O & M period, 10 percent discount rate, and zero inflations are used in the analyses.

Section 4.5 summarizes the capital, operation and maintenance (O&M) costs and low, baseline, and high present-worth costs for all five remedial action alternatives.

4.2 Remedial Component 1 – Remediation of Municipal Well No. 7

4.2.1 Remedial Action Alternative No. 1 – No Action

This alternative will not require implementation of any remedial actions after the RI/FS. Since no activities to remediate existing contamination in Municipal Well No. 7 are proposed under this alternative, technical and cost evaluations will not be performed. Institutional issues have been addressed in Section 4.1.3.

Public Health and Environmental Concerns

No action will not reduce any of the present or potential future risks associated with the use of Municipal Well No. 7. This is based on the current exposure, through ingestion, of groundwater from Well No. 7 of 9.4×10^{-4}. Well No. 7 will remain out of service indefinitely in this alternative.

However, the public health impacts associated with exposure to the water have been mitigated by the Township supplying alternative water through purchase from the Passaic Valley Water Commission.

Public opinion of this alternative would be unfavorable.

4.2.2 Remedial Action Alternative No. 2 – Purchase of Water From Passaic Valley Water Commission

The evaluation of this alternative is the same as that for Alternative No. 1. The only difference is that a cost analysis will be provided in Table 4-1.

4.2.3 Remedial Action Alternative No. 3 – Wellhead Treatment of Municipal Well No. 7

The purpose of this alternative is to remove or reduce the concentrations of contaminants detected in Municipal Well No. 7 to levels that would adequately protect the public health and subsequently enable the Township of Fairfield to restore the well to service. Under contract with the Township of Fairfield, Malcom Pirnie prepared a feasibility study on the possible treatment alternatives for Well No. 7 (Malcom Pirnie, 1983). A packed column aeration process was selected as the preferred alternative. The evaluation presented in this section is limited to information contained in the Malcom Pirnie report in light of present conditions and current regulations.

Technical Evaluation

Packed column aeration reduces the concentration of volatile organic compounds (VOCs) by providing a mechanism in which contaminants can be readily transferred from the water to the ambient air. Water falls through the air within a column and breaks into small droplets or thin films. This process results in the efficient removal of VOCs from the water via volatilization.

The technology associated with this alternative is effective, performs well, has a long-term useful life, and is based on standard engineering and scientific concepts. Packed column aeration has been used successfully to remove VOCs from groundwater at several locations in the northeastern United States (Malcom Pirnie, 1983). Pilot scale studies conducted by Malcom Pirnie at numerous locations have demonstrated excellent removals of VOCs (Malcom Pirnie, 1983). Based on experimental and full-scale testing, greater than 99 percent removal can be achieved through optimum design of packed column systems (Malcom Pirnie, 1983).

Malcom Pirnie conducted a pilot-scale testing program at Municipal Well No. 7 to evaluate treatment efficiency. With the exception of 1,1-dichloroethane, VOCs detected in Well No. 7 were reduced by between 85 and 99 percent with less than 10 feet of packing material. Removals of 1,1-dichloroethane ranged from 50 to 83 percent. In addition, the results indicate some removal of VOCs (46-58 percent) would be achieved, even if the column is operated without blowers online during maintenance or repair.

The design of this alternative may require modification prior to implementation. The maximum concentrations of 1,1,1-trichloroethane (630 µg/l), 1,1-dichloroethene (54 µg/l), and carbon tetrachloride (44 µg/l) exceed design concentrations used by Malcom Pirnie. Also, the average concentrations of trichloroethene, tetrachloroethene, 1,1,1-trichloroethane, 1,1-dichloroethene, trans 1,2-dichloroethane, and carbon tetrachloride exceed the historical average design concentrations. Based on the available data, it appears that the concentrations of VOCs have increased over time.

In addition, the design of the treatment facility is based on the reduction of trichloroethene to an effluent concentration of 10 µg/l. The effluent concentration of other compounds is estimated to be less than the design effluent concentrations of 10 µg/l. These design criteria were based on the anticipated promulgation of Maximum Contaminant Levels for VOCs of 10 µg/l. In November 1985, the USEPA proposed a Maximum Contaminant Level of 5 µg/l for trichloroethene. Consequently, the design of the proposed treatment system may require modification to meet Maximum Contaminant Levels.

The treatment system could be implemented in a relatively short period of time. Malcom Pirnie estimated that construction and start up of the facility could be completed 10 months after initiation of final design. The length of operation would depend upon remediation of the source or sources of groundwater contamination.

Public Health Concerns

Treatment of drinking water from Municipal Well No. 7 to recommended Maximum Contaminant Levels will adequately protect the public health. Long-term ingestion of drinking water following treatment is considered to pose minimal health risks, if effluent concentrations are maintained at design criteria (MCLs).

Emission of VOCs to the ambient air from the packed column aeration treatment system are not anticipated to result in adverse health impacts. Estimated ambient air concentrations (based on the design proposed by Malcom Pirnie) are below the

Occupational Health and Safety Act (OSHA) limits and the New Jersey Volatile Organic air emission limit of 0.1 lb/hour.

Institutional Issues

This alternative will meet applicable Federal and State standards related to the emission of volatile organics to the ambient air. A permit will be required for air emissions under New Jersey Administrative Code, Title 7, Chapter 27, Subchapter 8. If the design effluent concentration is below proposed Maximum Contaminant Levels, applicable drinking water regulations will be met.

4.3 Remedial Component 2 - Remediation of the Downgradient Contaminant Plume

4.3.1 Remedial Action Alternative No. 4 - No Action/Monitoring

Under the no-action alternative, additional activities to remediate the plume or eliminate present human exposure to contaminated groundwater would not be performed. However, a long-term monitoring program would be established to provide information on contaminant movement and to provide an early warning mechanism for groundwater users presently located outside the plume.

Technical Evaluation

This alternative will not reduce or eliminate any of the human exposures and subsequent health risks to groundwater users in the plume. It will be effective in providing information about the movement of contaminants so that future actions can be taken, if necessary. This alternative can be implemented almost immediately. Historically, monitoring has proven reliable.

Public Health and Environmental Concerns

If groundwater monitoring activities are performed, then workers who conduct sampling and sample handling activities would be exposed to the hazards inherent with handling chemicals associated with the site. Based on previous experience with these activities, the duration is very short, and such exposures can be adequately controlled to below acceptable levels by existing, readily available technologies.

Residual risks associated with the no-action alternative for groundwater have been described in detail in Section 9.0 of the Remedial Investigation Report. Table 1-7 of this FS report summarizes the potential human exposure pathways and subsequent health risks associated with exposure to contaminated groundwater. If this alternative is implemented, the acute, chronic, and carcinogenic health risks to groundwater users located in the plume would remain.

Institutional Issues

This alternative can be implemented without having to obtain any permits or other regulatory approvals.

4.3.2 Remedial Action Alternative No. 5 - Alternate Water Supply and Sealing of Private Wells

This alternative involves the installation of water service lines from the Township of Fairfield's existing street water supply mains to residential or commercial buildings located within the area of the contaminant plume (Figure 3-3). In addition, all domestic wells within this area will be sealed. Access to several wells at the perimeter of the plume will be retained for future groundwater monitoring.

The intent of this alternative is to eliminate the present and future health risks associated with potable and nonpotable use of contaminated groundwater.

Technical Evaluation

The technologies used to provide public water to a dwelling and seal existing wells are well-established, common engineering and construction practices. Municipal water systems are very reliable and require only a minimum of maintenance. Implementation would effectively eliminate present and future health risks associated with groundwater use.

In addition, this alternative could be implemented relatively quickly to provide remediation of present health risks. The estimated construction time for installation of water lines and sealing the domestic wells is 5 months.

The reliability and effectiveness of this alternative depends on obtaining additional information on the extent of groundwater contamination. Currently, there are limited RI groundwater data to evaluate the horizontal extent of the plume west of Passaic Avenue. Therefore, the proposed boundary of the water line installation and well sealing should be reevaluated and updated prior to implementation.

Public Health and Environmental Concerns

This alternative has no readily apparent occupational or public health risks associated with implementation. The low probability of construction-type accidents associated with heavy equipment operation and materials handling are not a major consideration. Occupational exposure during plume monitoring can be readily controlled. Environmental receptors should not be affected by short-term excavation and installation activities.

Implementation of this alternative would eliminate the acute, chronic, and carcinogenic health risks associated with exposure to contaminated groundwater. By eliminating the potential for ingestion, inhalation, and direct contact, the public health is adequately protected.

Institutional Issues

The alternative water supply can be provided by the existing local water authority once the installation of the water lines is complete. The installation should satisfy the authority's requirements. Implementation of the monitoring program will require the selection of an implementing agency.

4.4 Remedial Component 3 - Remediation of Onsite Wastes and Contaminated Soils

4.4.1 Remedial Action Alternative No. 6 - No Action

This alternative will not require implementation of any remedial activities after the RI/FS. There are no construction activities related to the performance, reliability, implementability, and safety evaluation criteria. Since no site activities associated with contaminated soils or wastes are proposed, technical and cost evaluations will not be necessary.

Public Health and Environmental Concerns

The no-action alternative will not reduce any of the present or potential future unacceptable risks to the public or the environment.

The potential health and environmental concerns associated with the no-action alternative for onsite soils and wastes have been described in detail in Section 9.0 of the Remedial Investigation Report. A summary of the risks associated with onsite soils and waste follows:

Exposure Pathway/Migration Route	Associated Risk
• Surface Soils - Direct contact and accidental ingestion	6.1×10^{-6} to 1.2×10^{-2}
• Wastes - Direct contact and accidental ingestion	5.3×10^{-6} to 3.7×10^{-3}
• Leachate - Ingestion of groundwater by downgradient receptor	5.5×10^{-6} to 1.4×10^{-2}

Presently, the potential for human exposure to subsurface soils and waste is low; however a significant degree of soil disturbance is likely to increase the risks to receptors. Also, subsurface contaminants are a source of groundwater contamination via the infiltration of precipitation and subsequent offsite migration in groundwater. The onsite source for groundwater contamination would remain if the no-action scenario is implemented.

Institutional Issues

Institutional issues related to this alternative include the delisting of the Caldwell Trucking Company Site under CERCLA or RCRA. This alternative does not satisfy any currently applicable State or federal (RCRA) standards for closure of a site containing hazardous materials and wastes.

4.4.2 Remedial Action Alternative No. 7 - Capping

Implementation of this alternative will result in the removal and treatment of the materials in the onsite storage tanks, the removal and offsite disposal of the storage tanks, the installation of a compacted soil cap over the areas with contaminated surface soils (North Lagoon Area and Central Lagoon Area), and the installation of a multimedia cap over areas with subsurface contamination (Central Lagoon Area). The intent of this alternative is to (1) reduce the infiltration of precipitation in contaminated soils and wastes, and subsequently reduce the potential for offsite transport via groundwater, (2) eliminate the potential health risks associated with direct contact, and/or (3) prevent the migration of contaminated surfaces soils via surface water runoff and wind erosion.

Technical Evaluation

Remedial Action Alternative 6 is based on technologies and engineering principles that have proven effective in reducing the rate and extent of contaminant migration, and in reducing the health risks and environmental impacts associated with conditions found at the site.

Placement of the multimedia and/or soil caps over the contaminated surface soils will effectively prevent exposure via dermal contact or accidental ingestion of contaminated surface soils.

Fencing the site will further reduce the potential contact with contaminated material. In addition, offsite transport via surface water runoff and wind erosion is effectively eliminated following implementation.

The multimedia cap placed over the contaminated surface and subsurface soils in the Central Lagoon Area will be effective in reducing the infiltration of precipitation into the waste materials and contaminated soils. However, contaminated subsurface soils or wastes in contact with the seasonal high water table will continue to contribute to leachate generation (and subsequent groundwater contamination) in the capped areas. Also, for this alternative to be effective, additional subsurface investigations would be required to completely delineate the horizontal extent of contamination in the CLA.

Additional geotechnical information on the stability or bearing capacity of the waste may be necessary. The waste lagoon may not be able to support the multimedia cap or the construction activities associated with installation. If required, the stability of the waste could be increased with commercial products or onsite borrow material.

The regrading and capping of the North Lagoon Area (NLA) and Central Lagoon Area (CLA) will require one-time operations. The soil and multimedia capping operations can be readily performed due to the relatively small construction area, the mild slopes of the site, and the material used in the cap design.

If the cap deteriorates over time, groundwater contamination would continue and the potential for adverse health risks and environmental impacts associated with direct contact exposures would be present. The caps may require replacement at some future time to maintain an adequate level of protection. The effectiveness of the caps will have to be evaluated continually over time and the systems modified accordingly.

The construction of the soil and multimedia caps can be accomplished with small- to moderate sized earth moving equipment, and an experienced construction crew. Excavation and disposal of the tanks can be readily implemented due to their relatively small size and the limited amount of excavation required for removal. The projected construction time is approximately 6 months depending upon conditions encountered at the site.

Maintenance of the capped areas is relatively minor. Periodic inspection of the caps, maintenance of the vegetation, and repairs to any eroded areas will be required.

Public Health and Environmental Concerns

Risks to remedial action personnel during implementation include general construction hazards, inhalation of volatile chemicals from contaminated surface soils, inhalation and ingestion of contaminated dusts generated from surface activities, and direct skin contact with site-associated contaminants. Workers can be protected from significant exposure through the use of readily available and accepted control technologies.

Airborne transport of either vaporous or particulate contaminants to offsite receptors should be negligible due to the minimal disruption expected from construction activities. Provisions to reduce stormwater runon and offsite migration of contaminated soils via runoff and wind erosion should effectively minimize health and environmental risks to offsite receptors.

Implementation of this alternative will address the following exposure pathways.

- Dermal contact with onsite soils and wastes

- Accidental ingestion of onsite soils and waste

- Dermal contact or accidental ingestion of offsite soils and sediments contaminated via surface water runoff or wind erosion

- Inhalation of airborne contaminated dusts or vapors

Capping of both the Central Lagoon Area and the North Lagoon Area will effectively eliminate the risks to receptors exposed or potentially exposed via those pathways.

However, this alternative will not mitigate the health risks to receptors who use groundwater for potable and nonpotable uses. In addition, contaminated subsurface soils in contact with the seasonal high water table will continue to contribute to leachate generation in the capped area and subsequently, would continue to contribute to groundwater contamination.

Implementation of Remedial Action Alternative 4 - Alternative Water Supply and Sealing of Private Wells would eliminate exposure to contaminated groundwater and subsequently eliminate the health risks.

Institutional Issues

The multimedia cap will meet current RCRA requirements. Also, offsite disposal of the tanks and tank wastes must comply with RCRA disposal, transport, and manifest requirements. In addition, institutional controls on groundwater use may be necessary.

4.4.3 Remedial Action Alternative No. 8 - Excavation and Offsite Secure Landfill

Implementation of this alternative will result in the removal of the contaminated subsurface and surface soils, the wastes in the tanks, and the wastes in the lagoon. These materials will be disposed in an approved EPA hazardous waste landfill. Additional onsite subsurface soil investigations are suggested prior to the design of this alternative to determine the extent of subsurface soil contamination. Post-remedial action groundwater monitoring will also be conducted to determine the effectiveness of this alternative.

Technical Evaluation

This alternative includes two key remedial technologies, excavation and offsite landfilling. Post-remedial-action monitoring will be conducted following the implementation of this alternative, if selected. Post-remedial-action monitoring has been fully described in Section 3.3 and will not be repeated in this section.

Excavation of the the contaminated surface and subsurface soils/wastes will be effective in removing the primary source for dermal exposure risks and the source of groundwater contamination on the site. Excavation techniques are commonly employed in conventional earthwork operations and are expected to be appropriate for removal of the soils and wastes. Implementation of excavation operations in the CLA is a potential problem because of the limited area and the presence of boulders.

Excavation of the contaminated soils is expected to cause a minimal potential risk to onsite workers and the local community. Level D safety protection is anticipated for remedial workers; however, dermal protective clothing will be required at a minimum.

A central decontamination station will be constructed onsite to clean excavation equipment and trucks prior to leaving the work and loading areas. Decontamination of equipment will minimize the transport of waste materials throughout the community. Additional onsite controls, such as dust suppression and erosion control, will be required, depending on weather conditions at the time of excavation.

Public Health and Environmental Concerns

Alternative No. 8 will address all of the present risks to the public and the environment. These include the following:

Exposure Pathway/Migration Route	Associated Risk
• Surface soils - Dermal contact and accidental ingestion	6.1×10^{-6} to 1.2×10^{-2}
• Wastes - Dermal contact and accidental ingestion	5.3×10^{-6} to 3.7×10^{-3}
• Leachate - Ingestion of groundwater by downgradient receptor	5.5×10^{-6} to 1.4×10^{-2}

The contaminated soils and wastes will be removed from publicly accessible locations and will be contained. The soils and wastes will not be exposed to precipitation, flood waters, or a high water table. This remedial action will prevent leaching of contaminants from the soils and the resultant groundwater contamination.

Excavation of the soils and wastes is expected to cause a temporary disruption in community daily activities, mainly because of the operation of heavy equipment and haul trucks. Work will be adjacent to residential and commercial properties and is expected to cause primarily a nuisance impact. Dust control measures will be used, if necessary, to minimize the effect on adjacent properties. Generation of harmful vapors or gases is not expected from excavation activities, although an increase in objectionable odors might occur. Relocation of local residences is not expected to be required. Short-term human health risks from excavation operations are expected to be acceptable and negligible.

Possibly a higher public risk will be associated with the operation and traffic of heavy equipment and haul trucks within the community. Safety considerations should be made for restricting the public from excavation areas and for control of equipment traffic within the community. Dust control measures should be employed on local roads, as required, to minimize the impact on residences.

Institutional Issues

Offsite disposal of waste materials in a permitted hazardous waste landfill facility fulfills the RCRA closure and post-closure criteria (40 CFR 264.310).

4.4.4 Remedial Action Alternative No. 9 – Excavation and Onsite Secure Landfill

Implementation of Alternative No. 9 will result in removal of the contaminated soils and wastes from the site with onsite landfilling of these materials in an area behind the General Hose Products plant.

Technical Evaluation

This alternative includes two key remedial technologies, excavation and onsite landfilling. Post-remedial-action monitoring will be conducted following the implementation of this alternative, if selected. Post-remedial-action monitoring has been fully described in Section 3.3.3.2 and will not be repeated in this section.

Application of the excavation technology at the Caldwell Trucking Company Site has been evaluated previously in Section 4.4.3 and will not be repeated.

Onsite landfilling will be effective in containing the contaminated materials and preventing dermal contact and leachate migration to the groundwater. The onsite landfill has been designed as a hazardous waste facility in accordance with the RCRA and NJDEP Regulations (NJAC 7:26-10.8).

A site evaluation should be performed prior to design to confirm the suitability of the landfill area. Specifically, soil types and stability, groundwater table location, borrow areas, and access requirements will need to be determined.

The landfill is expected to provide long-term containment of the waste materials, if ongoing maintenance and monitoring of the facility is assured. The useful life of the facility is not determinable because of the lack of long-term operational experience for landfills. Compatibility of the clay with the wastes is not expected to be a problem; however, laboratory studies should be performed during the design phase to confirm liner and cap compatibility with the wastes. The required 28,000 cubic-yard capacity of the disposal cell is relatively small and will involve development of approximately a 3.4 acre area. The time to implement the onsite landfill alternative is expected to be approximately 12 months. With the low temperature incineration pretreatment loop, the time of implementation may increase to 15 months.

Public Health and Environmental Concerns

Alternative No. 9 will address all of the risks to the public and the environment associated with the site. These include the following:

Exposure Pathway	Associated Risk
• Surface soils - Dermal contact and accidental ingestion	6.1×10^{-6} to 1.2×10^{-2}
• Wastes - Dermal contact and accidental ingestion	5.3×10^{-6} to 3.7×10^{-3}
• Leachate - Ingestion of groundwater by downgradient receptor	5.5×10^{-6} to 1.4×10^{-2}

Onsite disposal in a hazardous waste landfill is expected to provide containment of the contaminated materials and any liquid leachates. Residual risks to the public and environment are expected to be negligible. Long-term integrity of the disposal system will depend upon proper construction of the landfill cell and adequate maintenance and monitoring. A comprehensive Post-Closure Care Plan will be prepared that will address requirements for maintenance and monitoring over the 30-year post-closure care period. The post-closure period may be reduced or extended, provided that protection of the public health and the environment is assured. NJDEP has the responsibility for post-closure care and the determination of the post-closure period.

Excavation of the contaminated soils and wastes and construction of an onsite landfill is expected to cause a temporary disruption in community daily activities, mainly because of the operation of heavy equipment and haul trucks. Work in the site will be adjacent to residential and commercial properties and is expected to cause little impact. Dust control measures will be used, if necessary, to minimize the effect on adjacent properties. Generation of harmful vapors or gases is not expected from excavation activities, although an increase in objectionable odors might occur. Disturbance of local residences is not anticipated. Short-term human health risks from excavation operations are expected to be acceptable and negligible.

Institutional Issues

Alternative No. 9 will not meet all applicable Federal and state standards and regulations related to the siting of the onsite landfill as described in Section 3.0.

4.4.5 Remedial Action Alternative No. 10 - Excavation and Offsite Incineration

Offsite incineration will effectively destroy the organic contaminants in the soils and wastes and will complete the remediation scheme proposed for this alternative. The metals contamination in the ash will be the responsibility of the incinerator operator.

Technical Evaluation

Implementation of this alternative will result in excavating all contaminated soils and wastes and subsequent hauling of these wastes to a permitted offsite incineration facility. Site remediation will begin with excavating the contaminated soils and waste, as described previously. The amount of excavated materials and the methods of excavation are the same as those described previously. Therefore, the technical evaluation and the public health and environmental concerns of excavation, are not repeated here.

Incineration is a proven technology for destroying hazardous materials, including the organic contaminants at the Caldwell Trucking Company Site. Residual ashes, which remain after the thermal destruction of the waste material, will be properly handled by the operators of the incineration facility.

Public Health and Environmental Concerns

The health and environmental impacts of this alternative focus on excavation activities rather than incineration. This is because the implementation of the technology, namely incineration, is conducted offsite at a licensed and approved RCRA facility. The health and environmental impacts of incineration on the local community are, therefore, eliminated.

Institutional Issues

Offsite incineration at a licensed incineration facility will fulfill TSCA and RCRA requirements for PCB disposal and both the RCRA requirements associated with the remaining ash residual and the emissions requirement as defined by the National Ambient Air Quality Standards (NAAQS).

4.4.6 Remedial Action Alternative No. 11 - Excavation, Onsite Incineration, and Solidification

Technical Evaluation

This alternative was proposed in order to remediate the contaminated soils, and allow their redisposal on site. All of the technologies combined to form this alternative are established technologies which have been used for contaminated soil treatment. The key elements of this alternative include the incineration and solidification of the contaminated soils. Organic contaminants within the soil are to be destroyed by incineration, and the heavy metal contaminants will be fixed within the soil by the use of a solidification matrix.

Any onsite incineration system used will be required to meet all applicable incineration standards for organics including PCBs. At this time there is only one firm that has a full scale operational mobile incineration system. This system has been fully permitted, and has been used to decontaminate soils and sludges. Soils incineration would be completed by a team of experts supplied by the incinerator owner to assure proper system operation. Any water generated, a brine solution, as a result of the off gas treatment will also be handled by the incinerator operator. This water has been found in the past to be nonhazardous, which will not require extensive treatment offsite.

Soils incineration by a mobile unit can be accomplished at approximately 4 to 5 tons per hour. Continuous operation (24 hours) will be required to maintain proper combustion efficiency and to reduce fuel requirements. On this basis, complete soil decontamination could be completed within one year.

Solidification of the resulting soils and ash can be accomplished at the same rate as the incineration rate. This process will be done to stabilize and fix the inorganic contaminants within the soil matrix. Tests will be conducted on the final mass to assure that the permeability has been sufficiently reduced, and that the wastes are adequately fixed within the matrix.

An indepth evaluation of the technical aspects of soils solidification is not possible due to the limits of this study. As mentioned in Section 3.3.3.4, a significant amount of testing will be required to determine the proper solidification requirements for the onsite soils. The process that is selected will, however, be required to meet, at a minimum, the standards necessary to permit the onsite disposal of the treated soils.

Following the treatment of the soils, the resulting material will be placed back onsite into the excavated area. This area will have to be enlarged to accomodate the increased volume of the soil/cement mixture. This will require that a significant amount of clean soil be removed and relocated onsite to allow for the additional space. Alternately, the excess solidified soil can be placed in the area at the base of the highwall behind the General Hose Products plant. This may require earthmoving operations to provide sufficient room for disposal. The excavated materials can be used as cover material for the disposal areas. Once the treated soil is placed in this area the clean soil will be used as cover material. The solidified soil should be covered with at least 3 foot of cover to prevent damage from frost penetration.

Public Health and Environmental Concerns

This alternative should meet or exceed all relevant public health and environmental criteria except those requiring groundwater remediation. The soil organic contaminants will be reduced to nondetectable levels via incineration, and any gases produced will be scrubbed to prevent any contaminant emission to the atmosphere. Heavy metal contaminants will be fixed within the soil to minimize any release into the groundwater via leaching. Once the soils are replaced onsite, a soil cap will be necessary to protect the treated soils from environmental damage and will also serve to prevent any public contact. The complete alternative should render the soils nonhazardous, and remove them as a possible contaminant source.

Institutional Issues

CERCLA requirements permit the operation of onsite treatment and disposal activities without first obtaining federal permits. However, any action taken onsite must meet the requirements of the applicable regulations. The mobile incineration units that are commercially available have met and obtained RCRA and TSCA approval. The owners of the commercial units are currently seeking a blanket approval to permit operation throughout the country. This would facilitate efforts to begin incineration activities onsite.

A specific area of concern to the State of New Jersey with regards to incineration is the air emission from the mobile unit. Organic contaminant releases have specific limits that must be maintained for incineration operation. An individual organic compound release is limited to 0.1 pound per hour and total organics are limited to a release of 3.5 pounds per hour.

There are no specific requirements governing the solidification of contaminated soils. The design of the solidification process should be adequate to retard the release of inorganic contaminants to the point at which they are not contributing to the groundwater contamination. Periodic testing will be a necessary part of this alternative to assure that the cement/soil matrix performs as anticipated and up to design standards.

With regard to local requirements, permits may be required for construction activities, incineration fuel storage, waste handling activities, and landfill disposal activities. Some research of the necessary requirements should be made during the design phase.

4.5 Cost Evaluation Summary

This section outlines the applicable capital costs, O&M costs, and low, baseline, and high present-worth costs for all applicable remedial action alternatives. A summary of these costs is given in Table 4-1. Appendix B presents additional detailed information regarding the development of these costs. Detailed capital and O&M costing sheets, when applicable, are incorporated for each alternative. In addition, the various sensitivity factors that have been applied to capital and O&M costs are presented. Table 4-2 summarizes the sensitivity factors for each alternative.

TABLE 4-1

REMEDIAL ACTION ALTERNATIVES COST SUMMARY
CALDWELL TRUCKING COMPANY SITE
(Costs are in 1986 Dollars)

Remedial Action Alternative	Capital Cost ($1,000)	Annual O&M Costs ($1,000) Includes Monitoring and Post-Closure Maintenance (30 years)	Present-Worth Costs ($1,000)		
			Low	Baseline	High
Remedial Component 1					
1. No action	-0-	-0-	-0-	-0-	-0-
2. Purchase of water from Passaic Valley Water Commission	-0-	31.5	--	297	--
3. Wellhead treatment of Municipal Well No. 7	222	7.0	--	288	--
Remedial Component 2					
4. No action/monitoring	-0-	35.0	--	332	--
5. Alternative water supply and sealing of private wells	269	-0-	223	269	293
Remedial Component 3					
6. No action	-0-	-0-	-0-	-0-	-0-
7. Capping	740	18.1	783	911	1,123
8. Excavation and offsite landfill	18,188	26.2	9,625	18,434	27,441
9. Excavation and onsite landfill	3,166	41.0	2,664	3,554	4,752
• With low temperature vaporization loop	3,666	41.0	3,115	4,053	5,300
10. Excavation and offsite incineration	49,056	26.2	34,496	49,302	59,375
11. Excavation, onsite incineration,	42,463	26.2	41,783	42,709	43,964

TABLE 4-2

SENSITIVITY ANALYSIS SUMMARY
CALDWELL TRUCKING COMPANY SITE

Remedial Action Alternative	Sensitivity Cost Item	Baseline	Sensitivity Range (%)	Justification
No. 5 - Alternative water supply and sealing of private wells	Cost per tap-in to municipal supply	$900/tap-in	90,120	Uncertainty in the unit cost of additional tap-ins to the municipal system
No. 7 - Capping	Area for capping	42,500 sf	80,130	Uncertainty in the extent of contaminated subsurface soils in CLA
Nos. 8 through 11 - Excavation alternatives	Volume of excavated subsurface soils and wastes	26,400 cy	50,150	

REFERENCES

40 Code of Federal Regulations Parts 190 to 399, July 1, 1985. Protection of Environment. Office of the Federal Register, National Archives and Records Administration. U.S. Government Printing Office, Washington, D.C.

40 Code of Federal Regulations, Part 700 to end, July 1, 1985. Protection of Environment. Office of the Federal Register, National Archives and Records Administration. U.S. Government Printing Office, Washington, D.C.

Arbuckle, J. G., M. A. Brown, et al., 1985. Environmental Law Handbook, Eighth Edition. Government Institutes, Inc., Rockville, Maryland.

Federal Register, November 13, 1985. Drinking Water: Maximum Contaminant Levels (MCLs) for Volatile Synthetic Organic Chemicals; Rules. EPA. Vol. 50, No. 219, 46880-46901.

Federal Register, November 13, 1985. National Primary Drinking Water Regulations for Volatile Synthetic Organic Chemicals; Proposal Rule. EPA. Vol. 50, No. 219, 46902-46933.

Federal Register, November 13, 1985. National Primary Drinking Water Regulations for Synthetic Organic Chemicals, Inorganic Chemicals, and Nicroorganisms; Proposed Rule. EPA. Vol. 50, No. 219, 46936.

Federal Register, July 16, 1982. National Oil and Hazardous Substances Pollution Contingency Plan; Rule. EPA. Vol. 50, No. 224, 47912-47979.

Federal Register, January 14, 1985. Hazardous Waste Management System; Dioxin-Containing Wastes; Rule. EPA. Vol. 50, No. 9, 1978-2006.

Federal Register, October 3, 1983. National Revised Primary Drinking Water Regulations; Advance Notice of Proposed Rule. EPA. Vol. 48, No. 194, 45502-45521.

Federal Register, February 12, 1985. National Oil and Hazardous Substances Pollution Contingency Plan; Proposed Rule. EPA. Vol. 50, No. 29, 5862-5932.

EPA, June 1985. Guidance on Feasibility Studies Under CERCLA. EPA/540/G-85/003.

EPA, September 1985. RCRA Information on Hazardous Wastes for Publicly Owned Treatment Works. Office of Water Enforcement Permits.

Codification of Presidential Proclamations and Executive Orders. Executive Order 11988 - Floodplain Management. Chapter 40, 725-729.

Codification of Presidential Proclamations and Executive Orders. Executive Order 11990 - Protection of Wetlands. Chapter 40, 729-731.

ICF, Inc., December 18, 1985. Draft Superfund Public Health Evaluation Manual. Washington, D.C.

Federal Register, November 28, 1980. Water Quality Criteria Documents; Availability; Notice. EPA. Vol. 45, No. 231, 79318-79379.

Federal Register, February 7, 1984. Water Quality Criteria; Request for Comments; Notice. EPA. Vol. 49, No. 26.

Federal Register, June 12, 1984. National Primary Drinking Water Regulations for Volatile Synthetic Organic Chemicals. EPA. Vol. 49, No. 114, 24330-24355.

EPA, August 1984. Groundwater Protection Strategy, Washington, D.C.

New Jersey Administrative Code (N.J.A.C.), Title 7, Chapter 26, December 1985. Hazardous Waste Regulations. New Jersey Department of Environmental Protection, Trenton, New Jersey.

New Jersey Statutes Annotated (N.J.S.A.), Title 58, Chapter 10, 1985. Water Pollution Control Laws. New Jersey Department of Environmental Protection, Trenton, New Jersey.

New Jersey Statutes Annotated (N.J.S.A.), Title 58, Chapter 11, 1985. Water Quality Planning Act. New Jersey Department of Environmental Protection, Trenton, New Jersey.

New Jersey Statutes Annotated (N.J.S.A.), Title 13, Chapter 1, 1985. Hazardous Discharges Law. New Jersey Department of Environmental Protection, Trenton, New Jersey.

New Jersey Statutes Annotated (N.J.S.A.), Title 7, Chapter 1, 1985. Water Pollution Control Laws. New Jersey Department of Environmental Protection, Trenton, New Jersey.

New Jersey Statutes Annotated (N.J.S.A.), Title 7, Chapter 9, 1985. Pretreatment Regulations. New Jersey Department of Environmental Protection, Trenton, New Jersey.

New Jersey Statutes Annotated (N.J.S.A.), Title 7, Chapter 14A, 1985. Pollutant Discharge Elimination System Regulations. New Jersey Department of Environmental Protection, Trenton, New Jersey.

New Jersey Statutes Annotated (N.J.S.A.), Title 7, Chapter 9, 1985. Surface Water Quality Standards. New Jersey Department of Environmental Protection, Trenton, New Jersey.

Bowen, H. J. M. Trace Elements in Biochemistry. Academic Press, New York, 1966.

Malcolm Pirnie, Inc. Control of Volatile Organic Chemicals in Ground Water Supply System Well No. 7, Engineering Report, January 1983.

ENSCO Environmental Services, Inc., Technical Literature for Modular Incineration System, 1986.

Office of Technology Assessment, Response to Request from Senitors Bradley, Lautenberg, Congressman Hughes, and Florio for Review of Documents on the Onsite Cleanup of the Laparri Superfund Site. November 5, 1985.

Ellis, W. D., Pyne, J. R. The Development of Chemical Countermeasures for Hazardous Waste Contaminated Soil. JRB Assoc. Date unknown.

Kosson, D. S. et al. Development and Application of On-Site Treatment Technologies for Sludge Filled Lagoons. Rutgers, The State University of New Jersey. Date unknown.

"The Hazardous Waste Consultant", GE Evaluates Methods for Treatment PCB-Contaminated Soil. January/February 1986.

"The Hazardous Waste Consultant", A Guide to Innovative Hazardous Waste Treatment Processes. January/February 1986.

Tenzer, Raymond, et al. Mobile System for the Detoxification/Incineration of Cleanup Residuals from Hazardous Materials Spills, for the Environmental Protection Agency. Date unknown.

U.S. Environmental Protection Agency, Environmental Emergency Response Unit Capability. April 1982.

The Environmental Law Institute, 1986. Preliminary Report: Institutional Use Controls in Three Selected States. Office of Policy, Planning, and Evaluation, U.S. Environmental Protection Agency, Washington, D.C.

Schaum, J. November, 1984. Risk Analysis of TCDD in Soil. U.S. Environmental Protection Agency, EPA 600/8-84-031. Washington, D.C.